Introduction to Bare Earth and Feature Extractions

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Lidar: Principals and Applications

March 26, 2025

Contents

Overview

- I used LiDAR data from the National Map by the National Geospatial Program.
    - LiDAR data was used to differentiate between first returns of the laser (ground), and last returns (tops of buildings.)
- The goal of this assignment was to create a DTM using the best method to extract buildings from the data in Coralville.
    - To determine the most efficient way to create usable figures to work with in future assignments.

Data

- The Data used for this project are two LAS files (Lidar Point Cloud Data) collected from The National Map by the National Geospatial Program.
- The tile that I used was *USGS_LPC_IA_EasternIA_2019_B19_15TXG190130.las*

- This file is located in Coralville, Iowa.
- The time zone is NAD 1983 UTM Zone 15
- 1 km x 1 km tile

- This data that was downloaded from the National Geospatial Program has a higher point density that is more suitable for building reconstruction than other forms of data. (Linderman)

Methodology

- The overall goal is to extract bare earth data and to identify the above-ground data and features.
- I began by downloading the data and converting it from a LAZ file to an LAS file using a conversion tool.
- The first stage after getting my data ready was to determine how to make a digital terrain model (DTM) by isolating the ground points from the overall dataset.
  - I did this by using a classification tool to categorize these into the ground data.
  - After a few trials, I went with the LAS to DEM tool.
  - By doing this it makes it easier to differentiate between ground and above ground features.
- I then had to assign a height to the points above the ground.
- I then used a classification tool to separate between buildings/trees.
  - It did this by classifying the two, trees and buildings, into different categories depending on height and parameter.

- I then converted this new LAS file into a Multi-Point and then to a shapefile using conversion tools.
    - By doing this it allows me to work with just the points that represent buildings.
- After that I converted the Shapefile to a Grid also known as a Raster File
    - By doing this it cemented the building outlines.
    - While using these tools I tried different grid sizes for this shapefile.
- Then I converted this Raster File into Polygons.
    - I used the Simplify Building button on the Raster to Polygon tool.
        - This helped make the building outlines look “cleaner”.

Results

- The Digital Terrain Model (DTM) made from LiDAR points provided a smooth profile of the earth surface, and the non-ground features were almost completely eliminated.
- The Ground points from the last step were isolated with lasground and the resulting terrain raster generated with las2dem showed the changes in the Clear Creek watershed tile.
- Conversion from raster to polygon completed the outlines of individual buildings, although the raw shapes were often too jagged or asymmetric.
- Generalization tools like Simplify Building provided clean, squared building footprints which closely resembled real-world structures.
- The final building polygon layer matched well with aerial base maps and proved to be accurate in terms of shape and location.
    - As you can see in figure (1)

- Adding extruded building heights for 3D visualizations provided useful spatial context and made the data easier to interpret for further analysis or presentation.
    - As you can see in figure (3)

Discussion

- The dense LiDAR dataset increased the capability to detect and extract building features.
- The process of turning the point classification into polygons was critical in changing the basic LiDAR data into clean, usable building footprints.
- Switching classified points to raster, then to polygons provided a more detailed definition of building edges and allowed further analysis to be less complex.
- The use of generalization tools, for example, Simplify Building, helped enhance the building outlines.

Sources Cited

Marc Linderman “Exercise 3 22525” *LiDAR Principals and Applications* 3/27.

USGS *“The National Map”* National Geospatial Program

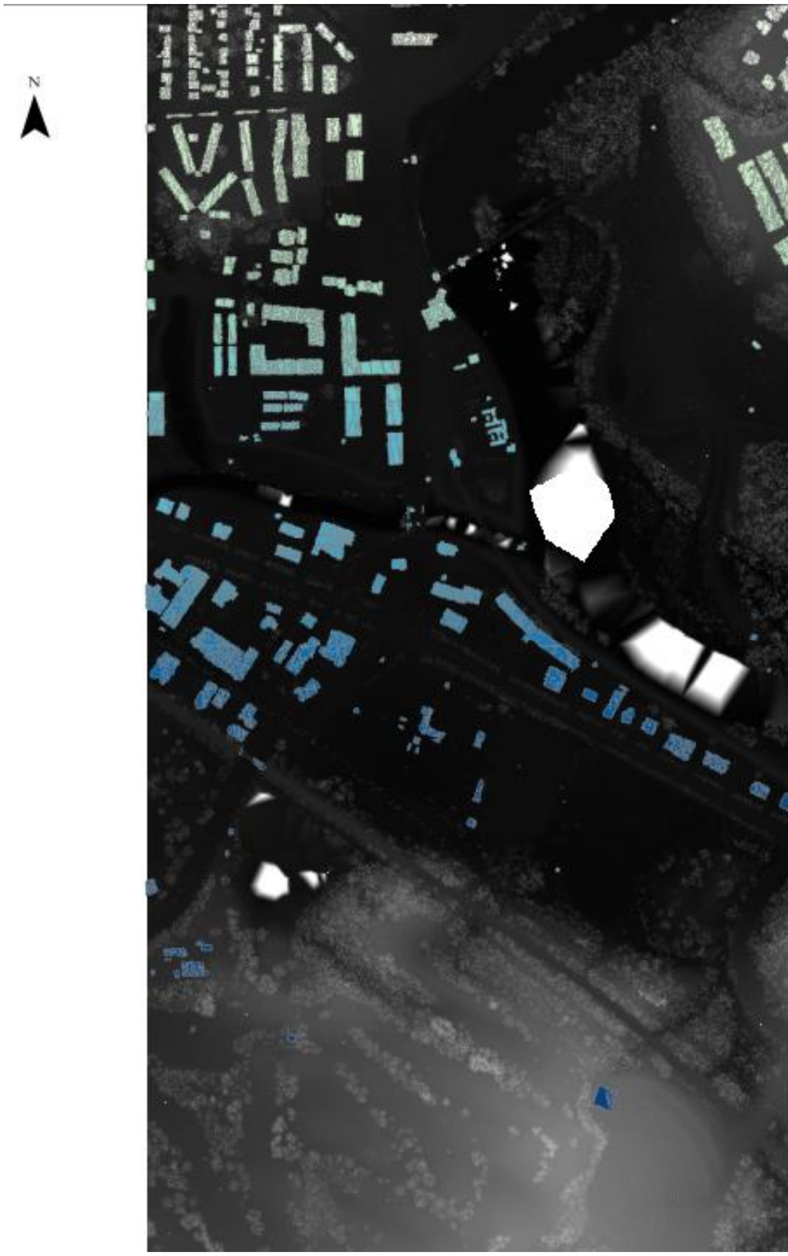
https://www.usgs.gov/programs/national-geospatial-program/national-map

What is lidar? National Ocean Services *Ocean Services* https://oceanservice.noaa.gov/facts/lidar.html#:~:text=Lidar%2C%20which%20stands%20for%20Light,variable%20distances)%20to%20the%20Earth.

Appendix:

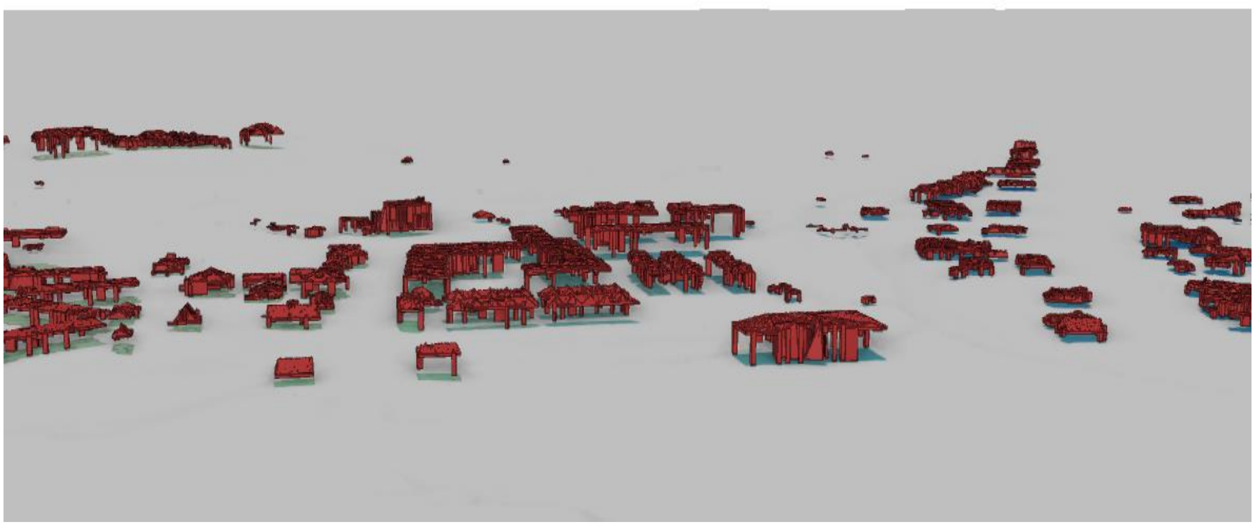
(Figure 1: Polygons figures of buildings Raster)

Appendix:



(Figure 2: Polygons figures of buildings Raster with the ground DTM behind it.)

Appendix:



(Figure 3: Extruded 3D Model)