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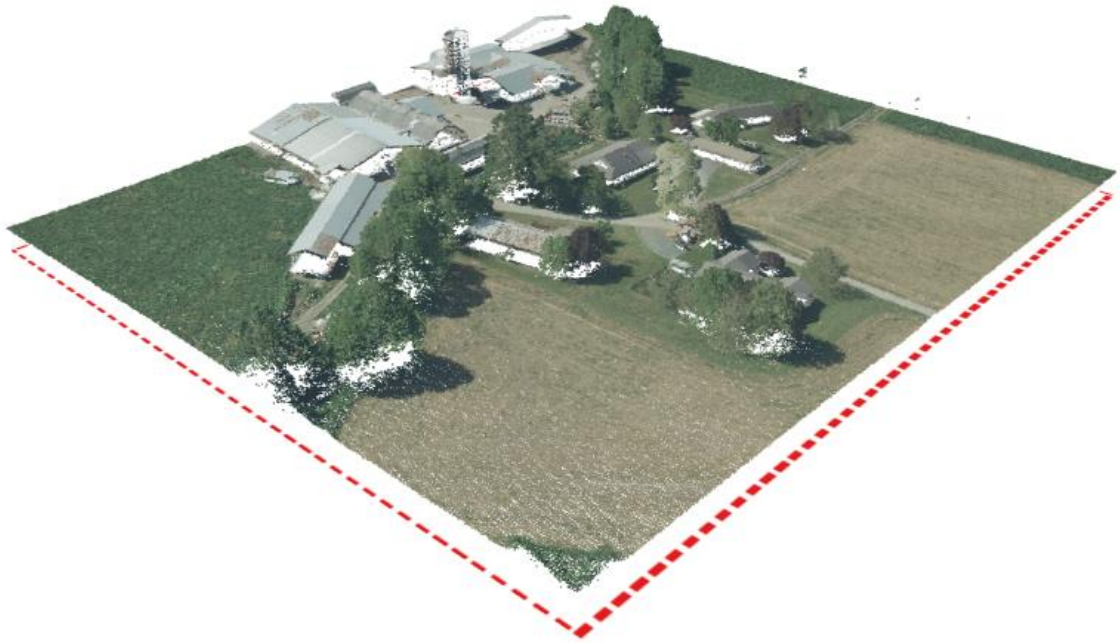

Point cloud visualization in QGIS

GIS Software for 3D Modeling: Practical use of GIS software for 3D modeling

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Valencia, Spain
04 - 08 December 2023

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1. Introduction

1.1. Purpose of Class

The purpose is to provide a comprehensive guide for importing, manipulating, and utilizing point cloud data in QGIS. It covers various aspects, from the basics of importing point clouds to advanced analysis and visualization.

1.2. Prerequisites

Before diving in, ensure that QGIS is installed on your computer. Additionally, a basic understanding of point cloud data and its applications in GIS would be beneficial.

2. Getting Started

Ready to dive into the world of point clouds? This chapter outlines the essential steps to get started, from installing the latest version of QGIS to accessing point cloud data covering the Netherlands.

2.1. QGIS Installation

Ensure that you have the latest version of QGIS installed on your computer. Download it from the official QGIS website (https://qgis.org/).

2.2. Point Cloud Data Format and Source

Utilize point cloud data from https://geotiles.citg.tudelft.nl/, covering the entire Netherlands. The data format is LAZ, compatible with QGIS.

2.3. Adding XYZ Tiles

Simplify navigation in your map canvas by adding an XYZ tile to your QGIS project. Follow the provided link to copy the required XYZ tile.
https://hatarilabs.com/ih-en/how-to-add-a-google-map-in-qgis-3-tutorial

2.4. Starting QGIS Project

1. Open QGIS on your computer.
2. Save the project in the Project home folder (for easy data retrieval).
3. Add the XYZ tile to your QGIS project for navigation.
4. Configure the coordinate reference system (CRS) if necessary, using EPSG 7415.

3. Data Import, Manipulation, and Visualization

Unlock the full potential of point cloud data in QGIS. This chapter guides you through the process of loading, visualizing, and manipulating point clouds, enhancing your skills in data analysis and presentation.

3.1. Loading Point Clouds into QGIS

1. In the QGIS menu, navigate to Layer > Add Layer > Add Point Cloud Layer...
2. Select point cloud files one by one to avoid overloading the computer.
3. Click "Add" to import the point cloud into your QGIS project.
4. Observe the frame of the point cloud.

3.2. Information and Statistics

1. Right-click on the point cloud layer in the Layers Panel.
2. Choose "Properties" from the context menu.
3. Navigate to the “Information” and "Statistics" tabs.

3.3. Styling Options

1. Right-click on the point cloud layer in the Layers Panel.
2. Choose "Properties" from the context menu.
3. Navigate to the "Symbology" tab.
4. Experiment with different styling options (e.g., point size, color ramps, transparency).
5. Click "OK" to apply the changes.

3.4. Adjusting Point Cloud Appearance

1. Access the Layer Styling Panel by clicking on the "Layer Styling" icon.
2. Use "RGB, Attribute by ramp, and Classification" to colorize points based on attributes.
3. Click "Apply" to see real-time changes.

3.5. Filtering Points

1. Open the Layer Properties dialog for your point cloud layer.
2. Navigate to the "Source" tab.

3. Use the "Query Builder" to filter points based on attributes (e.g., elevation, classification).
4. Click "OK" to apply the filter.

3.6. Extracting from Point Cloud

1. Select the Point Cloud layer.
2. Navigate to Processing toolbox > Point Cloud Extraction > Filter.
3. Choose the point cloud layer in the Input Layer.
4. Create a filter expression.
5. Save the file in the result folder.

3.7. Calculate Density of Point Cloud

1. Select the Point Cloud layer.
2. Navigate to Processing toolbox > Point Cloud Extraction > Density.
3. Choose Point Cloud data and select density raster resolution.
4. Save your raster data.

3.8. Clipping Point Cloud Data

1. Create a polygon layer and draw a random polygon within the point cloud extent.
2. Select the point cloud layer.
3. Go to Processing Toolbox > Point cloud data management > Clip.
4. Choose the Input Layer and Clipping Polygon, adding a filter if needed.
5. Select a folder and name the clipped point cloud layer.
6. Run the operation to clip the point cloud.

4. Terrain Analysis

Take your analysis to the next level with terrain-focused operations. This chapter covers exporting points, creating contours, and generating rasters from point clouds, providing insights into terrain characteristics.

4.1. Export Point from Point Cloud

1. Navigate to Processing toolbox > Point Cloud conversion.
2. Select export to vector.
3. Choose the point cloud dataset.
4. Select the attribute to be exported.
5. Apply a filter if needed.
6. Save the new file in the result folder.

4.2. Create Contours from Point Cloud

1. Open the Plugins menu.
2. Install the Contour Plugin and run it.
3. Select the point layer.
4. Choose the data value.
5. Tick "Remove duplicate points."
6. Select "Fixed contour interval" as a method.
7. Assign the required interval and number.
8. Press "Add."

4.3. Create Raster from Point Cloud

1. Navigate to Processing toolbox > Point Cloud conversion.
2. Select export to raster (two options are available).
3. Choose the point cloud data in Input Layer.
4. Select the attribute (e.g., Z) and assign the resolution of the density raster.
5. Save the exported file in the result folder.
6. Try different options to represent the raster.
7. Navigate to View menu > Elevation Profile to check the interpolation result on the profile.

5. Point Cloud Data Spectrum Composition

We have infrared spectrum instead of near infrared, nevertheless we can still create interesting compositions. While the specific bands and their characteristics can vary based on the sensor and dataset you're working with, here are some general ideas for combinations using red, blue, green, and infrared bands:

The following steps are supposed:

1. Select Point Cloud layer.
2. Right click on Layer select Properties from context menu.
3. Go to Symbology tab and select RGB, if not selected.
4. Change the Red Band, Green Band and Blue Band according to composition presented below:
5. Press Apply to see immediate changes.

Natural Color Image:

Red: Red band
Green: Green band
Blue: Blue band
This is the standard true-color combination that closely resembles what the human eye sees.

False-Color Infrared (IR):

Red: Infrared band
Green: Red band
Blue: Green or blue band
This combination can highlight vegetation and landscape features, with healthy vegetation appearing bright red.

Vegetation Analysis:

Red: Infrared band
Green: Green band
Blue: Blue band
Emphasize the infrared band to enhance the visibility of vegetation. Healthy vegetation will appear bright.