



Visualizations of High Fidelity 3D Citywide Dataset

Use Classified LiDAR Point Cloud to Visualize Ground Features and Support ESG (Environmental, Social and Governance) Measurement

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Abstract

Many professionals, such as urban planners, civil engineers, and environmental consultants, use geospatial information (e.g., building locations, terrain, vegetation, etc.) to make decisions. It is not always easy to obtain such information directly from online resources like Google Map, especially when the site of interest is in the rural or suburb areas.



Google map screenshots (Downtown Vancouver vs. Farmland in interior BC)

Creek, trail, or powerline?
Hillside or flat ground?
Pond or House?

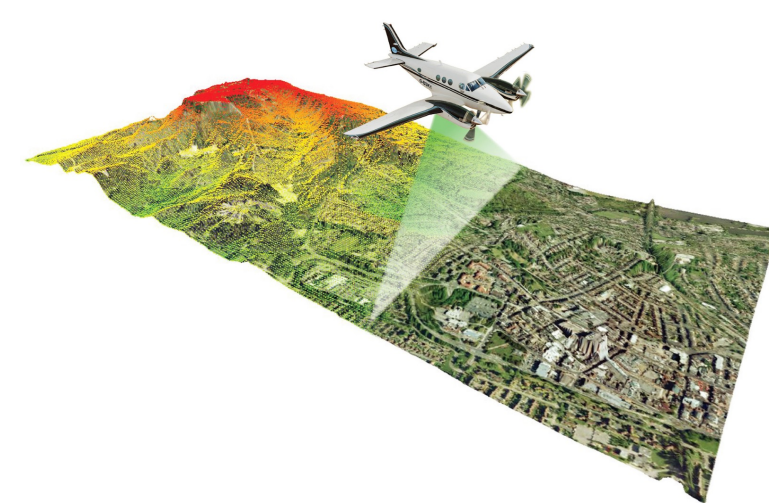
LiDAR (Light Detection and Ranging) technology has been widely used in the industry for geospatial data collection. In this project, we build a web application to visualize and analyze LiDAR point cloud data. After uploading the point cloud data, users will be able to:

- 1) See the 2D visualization of the point cloud data;
- 2) See the 3D visualization of the area in an interactive mode;
- 3) Check coverage and distribution of different features.

Methodology

Technical Stack: Frontend (HTML/CSS/JavaScript); Backend (Python Flask); Data Processing (Open3d)

Data Preparation: Users need to provide their own point cloud data. In our demo, we use open-sourced LiDAR point cloud data from Vancouver (2018) and Surrey (2013).



Airborne LiDAR survey

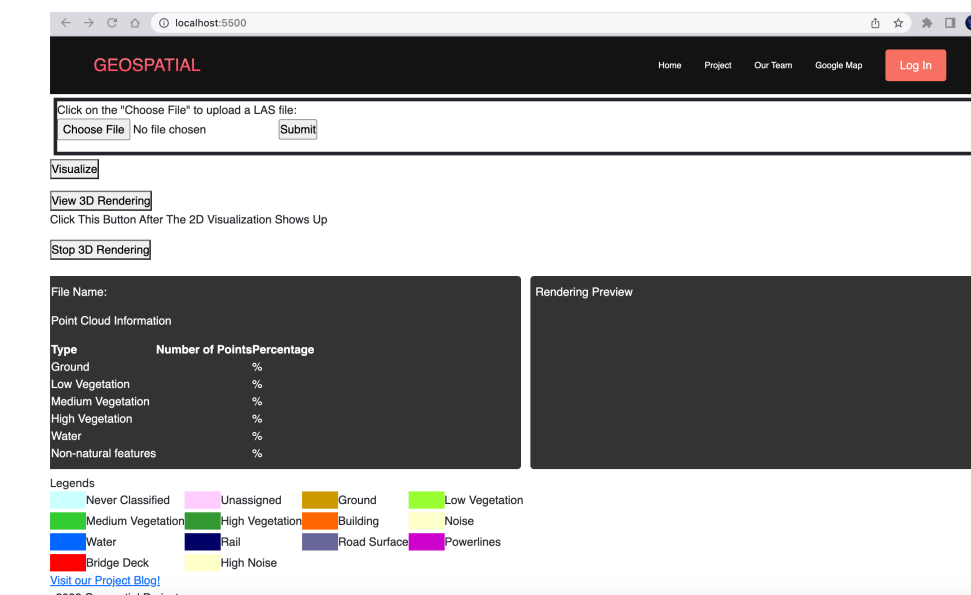


LiDAR scanner

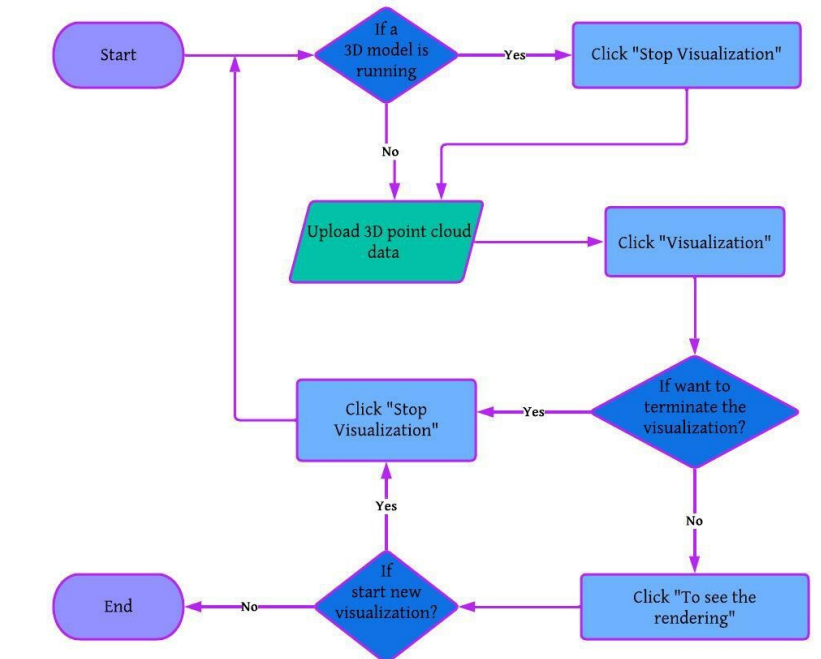
pentagon - pentagon							
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Example of Point Cloud data

UX Diagram and Design



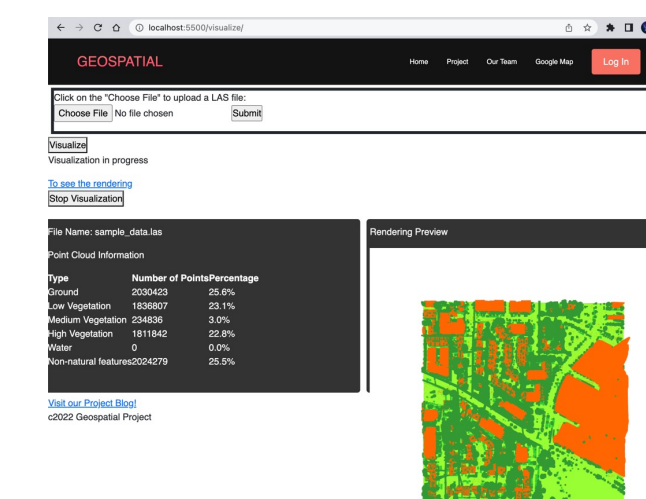
Web page screenshot



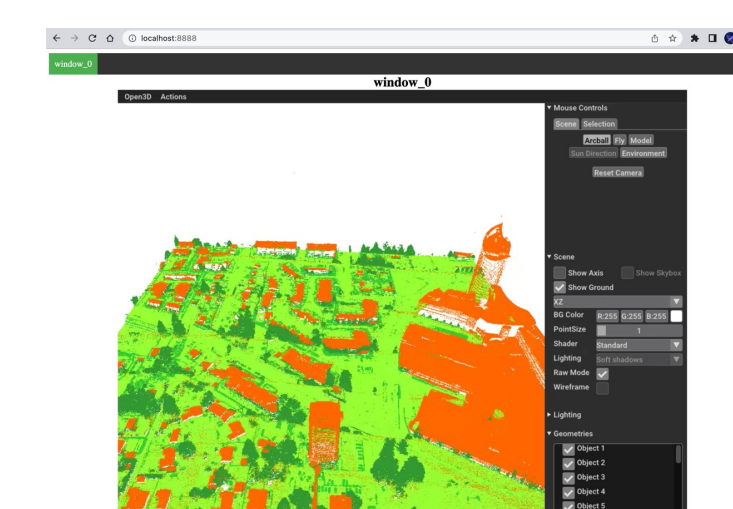
UX diagram

Result

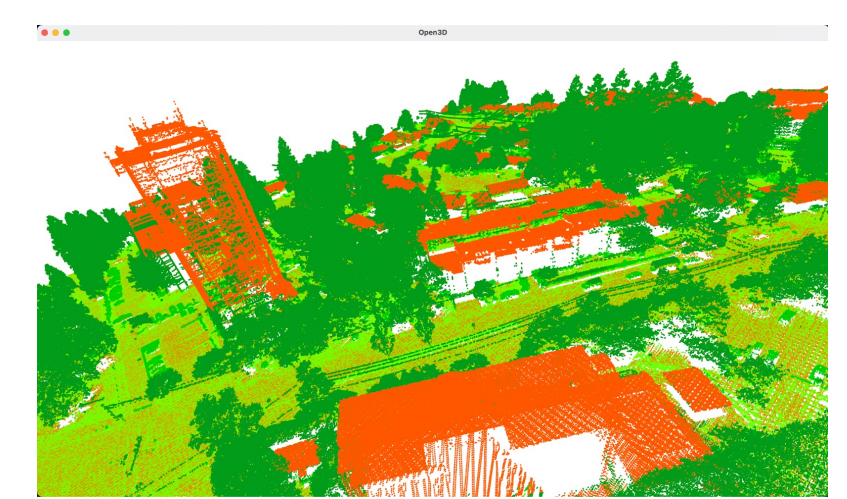
The 2D image can provide a visual representation of the area, which will help users to get a rough idea of what features present in the surveyed area. To further explore the area, users can enter check the 3D visualization, which will show more details of each feature in 3D space.



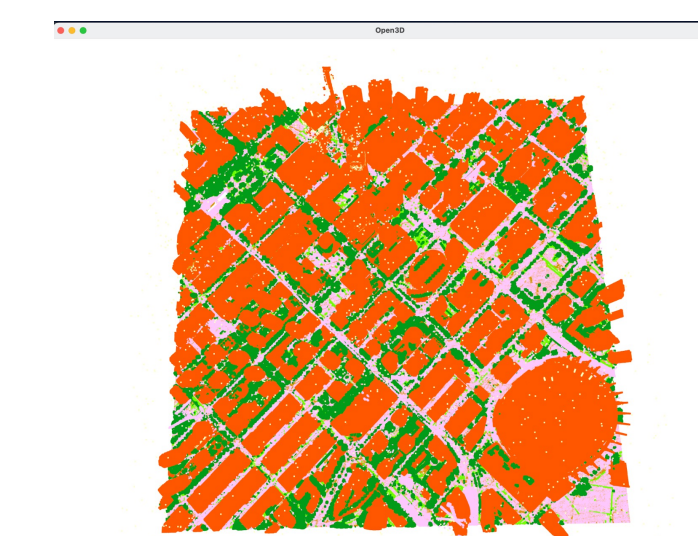
Feature Calculation and 2D image



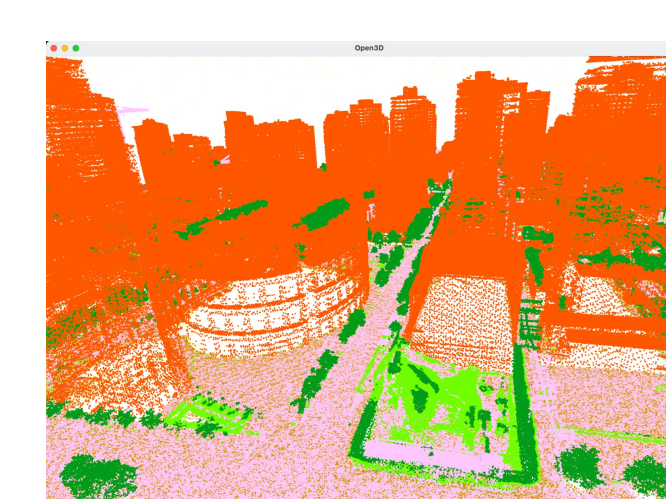
3D Visualization Page



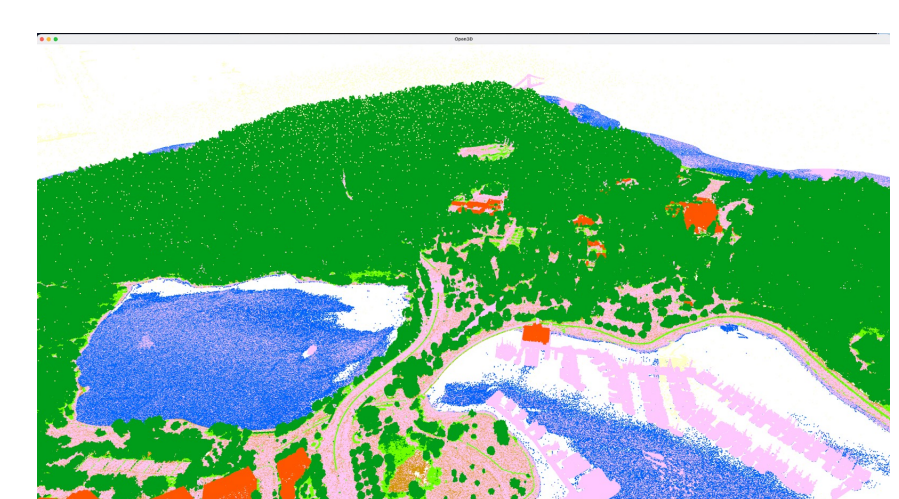
Visualization Sample: Surrey in 2013



Greenspace of downtown Vancouver



(Pre-construction) Northeastern University



Stanley Park

Future Work

Website deployment: Before deployment, we need to solve some Open3d dependency issues. The challenge is to build all open3d dependencies from source on the server and enable headless rendering.

Element isolation: Elements in the 3D model can be chosen individually and shown in a new window along with information about the element.

Point Cloud Classification: Future iterations of this application will also support unclassified Point Cloud data.

More information for visualized 3D model: Advanced functions such as calculating the volume of objects would be developed to provide more information and insights about the surveyed area.