3D Point Cloud using Python - CloudComPy

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I. INTRODUCTION

A. Background

CloudCompare is a 3D point cloud processing software which can manipulate triangular meshes and calibrated images. The software was created when there was a collaboration between Telecom ParisTech and the R & D department of Electricite de France. This project was started by the PhD student, Daniel Girardeau-Montaut with the research topic of "Change detection on 3D geometric data", the research purpose is to acquire laser scanners to detect changes in 3D high density point clouds in industrial facilities. Next, This software was developed with the advanced 3D data processing software. Fortunately, CloudCompare is an open source software. CloudCompare provides advanced processing algorithms by performing 3D point cloud and triangular meshes such as distance and statistics computation, projections, segmentation, registration and geometric features estimation. This report will demonstrate the analyzation of lidar point clouds data using CloudCompare in Ubuntu's python environment.

B. Objective

- To analyze the datasets of lidar point cloud data.
- To debug the python script for CloudCompare Python Application Programming Interface framework.
- To run the python script to execute and open the CloudCompare software application.

II. METHODOLOGY

i) Installation of Anaconda3

The CloudCompare application will be run on the Ubuntu system. To be able to run the binary files of Cloud Compare, Anaconda3 must be installed in the Linux (or Ubuntu) system to create a suitable environment for the binary files to run.

ii) Creating Anaconda3 environment

An Anaconda3 python environment is created with Python version 3.9 for the binary files of CloudCompare to be built inside the environment. The environment can be built by inserting commands in the Ubuntu terminal as below:

[line 1]. ~/anaconda3/etc/profile.d/conda.sh
[line 2]conda activate
[line 3]conda create --name CloudComPy39 python=3.9

iii) Configure CloudComPy39 environment

A python environment named 'CloudComPy39' was created in last step. The next step will be activation and configuration of the environment. The environment can be activated and configured by inserting commands below:

[line 1]conda activate CloudComPy39
[line 2] -conda config --add channels conda-forge
[line 3] conda config --set channel_priority strict
[line 4] conda install qt numpy psutil boost xerces-c pcl gdal cgal cmake pdal opencv ffmpeg mysql "qhull=2019.1" matplotlib "eigen=3.3.9" tbb openmp

The Ubuntu terminal can be closed after configuration of the environment had been made.

iv) Install CloudCompare binary files

The binary files of CloudCompare can be downloaded from https://www.simulation.openfields.fr/index.php/download-binaries. The downloaded files needed to be extracted and merged into the Anaconda3 python environment file created. For the 'CloudComPy39' environment created, the environment file can be found at path 'anaconda3/envs/CloudComPy39/.

v) Activating Anaconda3 environment

The CloudCompare Application needed to be run with the 'CloudComPy39' environment created. To activate the environment and set the environmental variable for CloudCompare, command below can be used:

[line 1]. ~/anaconda3/etc/profile.d/conda.sh
[line 2]conda activate CloudComPy39
[line 3]export LD_LIBRARY_PATH=~/anaconda3/envs/CloudComPy39/lib:${LD_LIBRARY_PATH}
[line 4]export LD_LIBRARY_PATH=~/anaconda3/envs/CloudComPy39/lib/cloudcompare:${LD_LIBRARY_PATH}
[line 5]export LD_LIBRARY_PATH=~/anaconda3/envs/CloudComPy39/lib/cloudcompare/plugins:${LD_LIBRARY_PATH}

The CloudCompare binary files is ready to run after the environment had been activated.

III. RESULTS AND DISCUSSION

i) Application Programming Interface (API) testing

First and foremost, API testing is ran to determine whether the application meet expectations for functionality, reliability, performance, and security for the system. The API test file can be found by changing directory in Ubuntu terminal to the path 'anaconda3/envs/CloudComPy39/doc/PythonAPI_test'. API test can be run by interesting command 'ctest' in the terminal. Figures below shows the result of API test obtained:

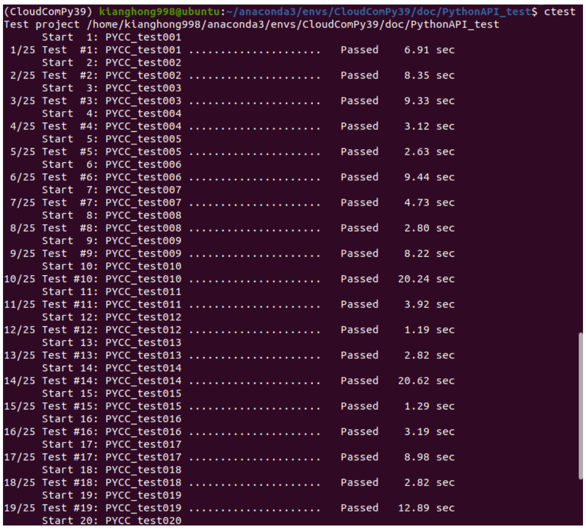

Figure 1: Beginning of API test

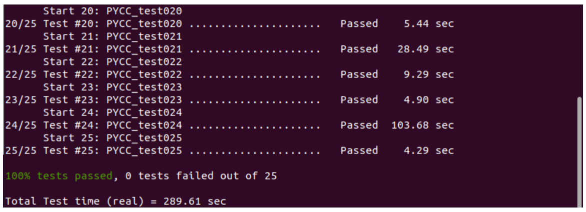

Figure 2: End of API test

From the figures above, it is shown that the API test for the CloudCompare application had fully passed. The application is ready for analyzing lidar point cloud data now.

ii) Analyzing lidar point cloud data

The CloudCompare application can be run on the activated python environment created by changing the directory in Ubuntu Terminal through inserting the command below:

~/anaconda3/envs/CloudComPy39/bin/CloudCompare

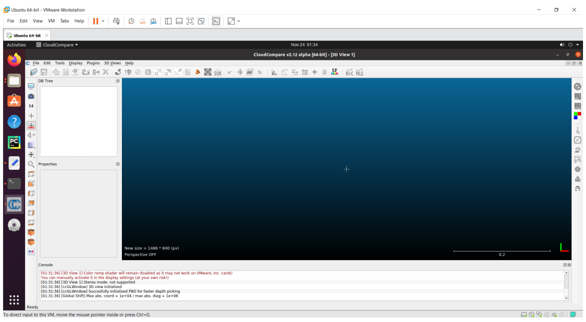

Figure 3: CloudCompare application running on Ubuntu system

To test the ability of the application to analyze lidar point cloud data, the application will run 5 lidar point cloud data (Baran.las, Gladiol.las, Kaliancar.las, Kalisapu.las, and Ngombak.las). The results for the data are shown below:

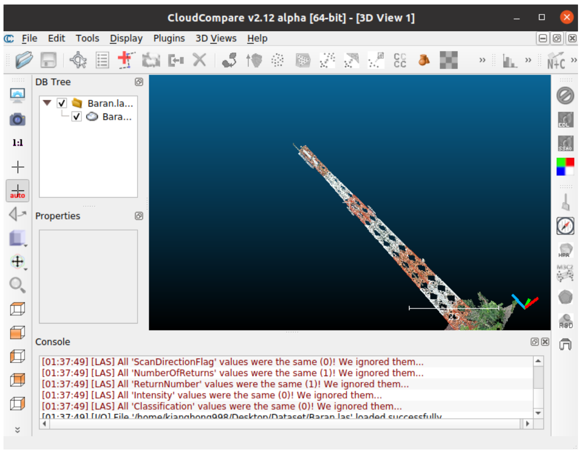

Figure 4: Result for Baran.las

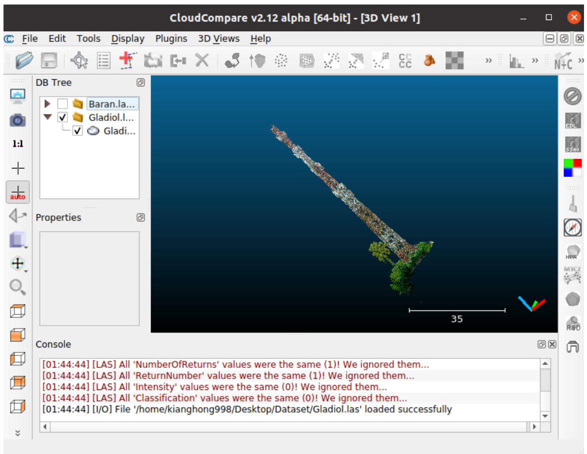

Figure 5: Result for Gladiol.las

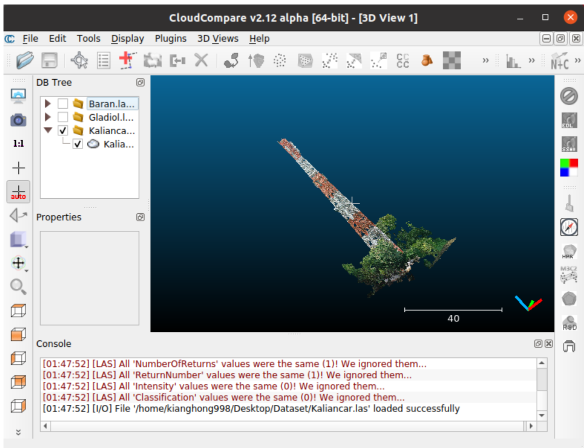

Figure 6: Result for Kaliancar.las

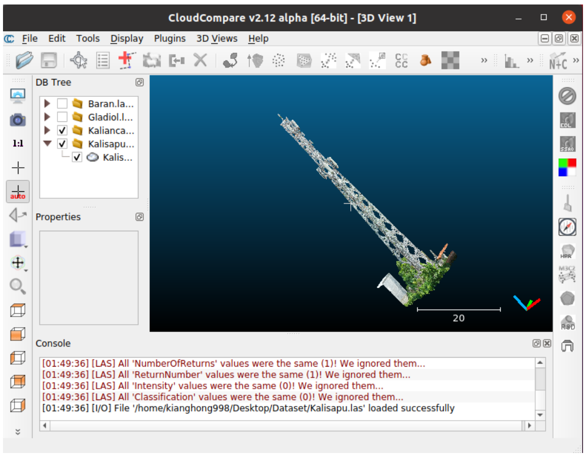

Figure 7: Result for Kalisapu.las

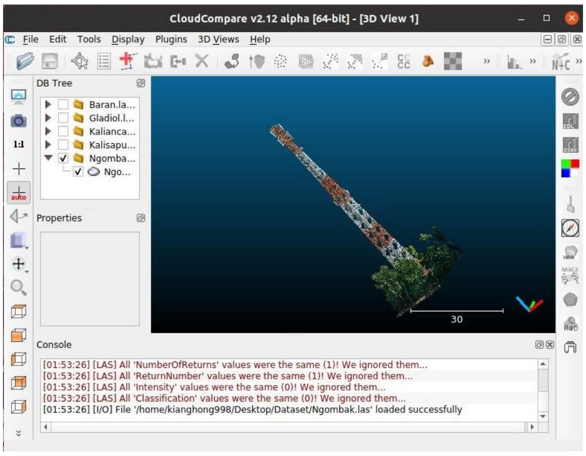

Figure 8: Result for Ngombak.las

From the results, it is observed that the application managed to run all the fives lidar data files. The results had showed that the application can be used to analyze the datasets of lidar point cloud data.

IV. CONCLUSION

The CloudCompare application had been installed and ran on python environment created on Ubuntu System to analyze lidar data files. Through the processes, objectives of this project were successfully achieved by analyzing the lidar data sets, debugging the CloudCompare API framework and executing the python script to open the CloudCompare software.

V. REFERENCES

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