TITAN to Google Earth: Work flow for Data Processing for Mobile Terrestrial LIDAR

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Abstract

Terrestrial LIDAR scanners are pushing the boundaries of accurate urban modelling. Automation and the usability of tools used in feature abstraction and, to a lesser degree, presentation have become the chief concerns with this new technology. In order to broaden the use and impact of LIDAR in the geomatics, LiDAR datasets must be converted to feature-based representations without loss of precision. One approach, taken here, is to simultaneously examine the overall path that data takes through an organization and the operator-driven tasks carried out on the data as it is transformed from a raw point cloud to final product. Presented here is a review of the current practices in LiDAR data processing and a foundation for future efforts to optimize.

Background and Relevance

Terrestrial mobile LIDAR scanners integrate precise positioning technology with laser ranging to allow the acquisition of precise 3D locations from objects along transportation corridors at flow-of-traffic speeds. The TerraPoint TITAN system was used to acquire urban infrastructure for Kingston, Ontario; in less than six hours this system generated over 15GB of 3D point locations in geographic coordinate space. This presents a pair of problems: how do experts and non-experts cope with such data volumes effectively, and how can they then communicate their results or share their information products?

The normal acquisition and processing pipeline of TITAN LIDAR data includes survey planning, location control setup, mobile data acquisition, pre-processing and position correction of the acquired data. Concerns arise over what options exist from this point forward, especially at the client side where specialized tools are often too expensive or complex for adoption.

The options for processing LiDAR include: Handling and display of points in specialized LIDAR software tools, directly integrating points with off the shelf consumer software and communication tools, or taking intermediate results from LIDAR tools into consumer software.

Methods

We examine alternative LIDAR processing workflows with two key questions in mind: computational efficiency - whether the process can be done using the tools at all - and tool complexity - what operator skill level is needed at each step. Using these workflows the usability of the specific software tools and the required knowledge to effectively carry out the procedures using the tools are examined.

Workflows based on dedicated LIDAR tools such as InnovMETRIC Polyworks, commercial modeling tools such as Autodesk 3D Studio Max and Google SketchUp, and using output platforms such as Google Earth and other GIS visualization tools provide case studies of the spectrum of options. We specifically target desired end products such as geographic flythrough and widespread data proliferation via Google Earth where the users may have little knowledge or even interest in the technical details of LIDAR acquisition and processing, but simply wish to visualize a local environment with the accuracy that LIDAR can provide.

Results

Preliminary results of this work has yielded workflows that successfully translate LIDAR to 3D object models, highly decimated point representations of street data represented in Google Earth, and large volume point data flythroughs in ESRI ArcScene. We are documenting the pragmatic limits on each of these workflows and tools, both in terms of computation time and realistic performance in the hands of end-users.

Conclusions

Terrestrial LIDAR brings with it new innovations for spatial visualizations, but also questions of viability. The technology as proved valuable for specialized applications for experts, but it is important to examine whether this technology can be useful as a tool for proliferating 3d spatial information by and to non-experts. This study illustrates the issues associated with preparing 3d LIDAR data for presentation in mainstream visualization environments.