Increasing the value of lidar and UAV point-clouds

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Over the last decade, lidar data has evolved from a luxury commodity to a fairly ubiquitous and readily available resource. While the underlying technology has been around for more than 50 years, only relatively recently has lidar found its way into mainstream GIS. This rapid evolution can be attributed to both a steady decrease in the costs involved in the data collection process and perhaps more importantly, to an increase in awareness of lidar data and its potential application in a wide variety of fields.

Concurrent with the expanded availability of lidar data, many software companies have developed ever more powerful applications to process the raw point-cloud files. These software offerings run the gamut from simple data viewers to complex analysis tools. Sitting squarely between these extremes is Global Mapper, an inexpensive desktop GIS application from Blue Marble Geographics. Among the 250 file formats that can be imported and exported by the product are LAS and LAZ, as well as several proprietary point-cloud formats. More than just a viewing tool, the appliation offers an array of functions for querying, filtering, and editing a point-cloud, all of which serve to increase the value of the data and to improve the precision of any analytical processes that are applied to this data.

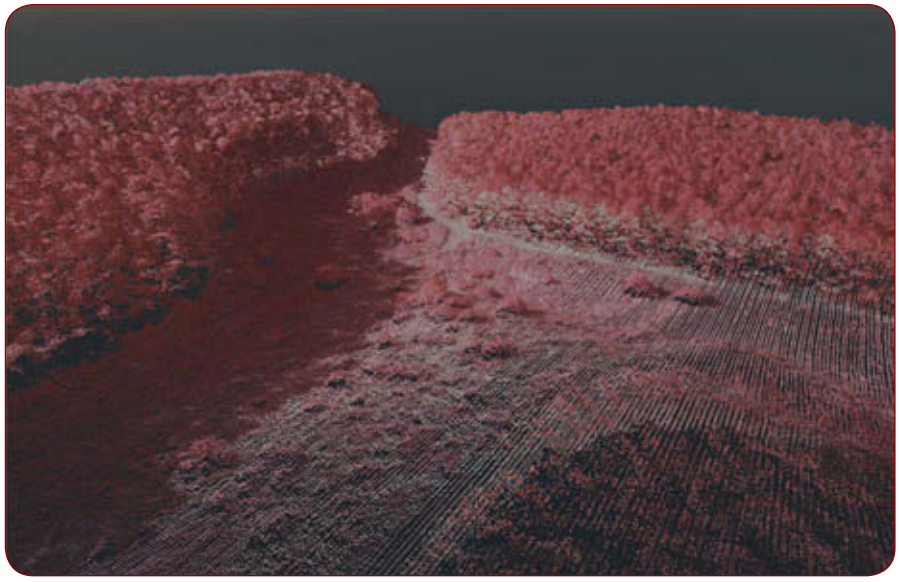

Fig. 1: Lidar point-cloud of cleared plantation.

Global Mapper was an early supporter of lidar data formats and has been in a continual cycle of development ever since. This dynamic approach to the software release process has ensured that it is able to immediately address the ever-changing needs of the lidar-user community. As new versions of the LAS and LAZ formats are introduced or as new classifications are added to the format specifications, the product has been upgraded in real time to reflect these changes. Furthermore, as point-clouds have increased in size – reflecting the exponential expansion in the geographic areas over which lidar data has been collected – the application's data handling capability has been updated to allow the efficient processing of datasets containing billions of points. This evolutionary process has ultimately led to the development of the Global Mapper Lidar Module, a collection of advanced lidar processing tools that is available as an add-on component to the software.

One of the persistent challenges when working with lidar is that data consumers are often many levels removed from those who actually collect the data. As a result, the specifications that are applied to the native files are often incompatible with the requirements for a particular project. This issue is most commonly seen in the classifications denoting the type of surface represented by each point. Commonly used classes include unclassified (1), ground (2), low, medium, and high vegetation (3, 4, and 5), and building (6). Depending on the data provider, the point-cloud may or may not include the required classes, and as result it is often necessary to update or edit this component of the data. The module has been developed in large part to address this requirement and it provides many ways to update the classification of lidar points.

Manual classification

Global Mapper includes a powerful digitiser function, which offers a suite of vector data creating and editing tools. Given that lidar points are inherently vector in format, it is very easy to select one or more points and simply update the original classification. Most lidar files contain tens or even hundreds of millions of points, so manually editing many points using this method is impractical; it does however

allow individual anomalies that might corrupt the data to be addressed.

Geographic reclassification

The application includes several advanced selection options that can be used to universally highlight and edit all objects within a defined geographic area. In this highlighted state, a universal edit can be applied to all points assigning a consistent classification that reflects the nature of the area. For instance, a building footprint layer could be used to select all points with the bounds of each building polygon so the classification of the points can be quickly and easily changed to the building class.

Tabular filtering and editing

As with all vector data, lidar points include an array of attributes that can either be displayed individually or in a tabular form. The search function in Global Mapper offers this tabular perspective and it includes many options for sorting, querying, and filtering the data. As well as providing an easy way to remove unwanted points this powerful component of the software can be employed to collectively reclassify queried points.

Cross-sectional reclassification

The software's path profile tool was originally developed to display a cross-sectional view of a raster elevation layer. With the introduction of the lidar module, this tool can now be applied to a point-cloud. Defining a cross-sectional path through an array of points in the 2D map view triggers the display of a window that displays a lateral perspective of the same path. Extending the width of the swath outward from the original line provides the option to display all of the points covering a recognisable feature such as a building. Given that the corresponding points are clearly visible above the ground, they can be easily selected and reclassified to the appropriate classification value.

Automatic detection of ground points

Perhaps the most powerful feature of the module, the automatic ground classification tool significantly increases the value of a point-cloud by assigning the ground classification to points that would otherwise be unusable for terrain surface creation and analysis. A complex and customisable algorithm is used to discern patterns in the point-cloud that indicate the presence of a terrestrial surface as opposed to a raised feature. This process can even be applied to a point-cloud in which all points are initially unclassified.

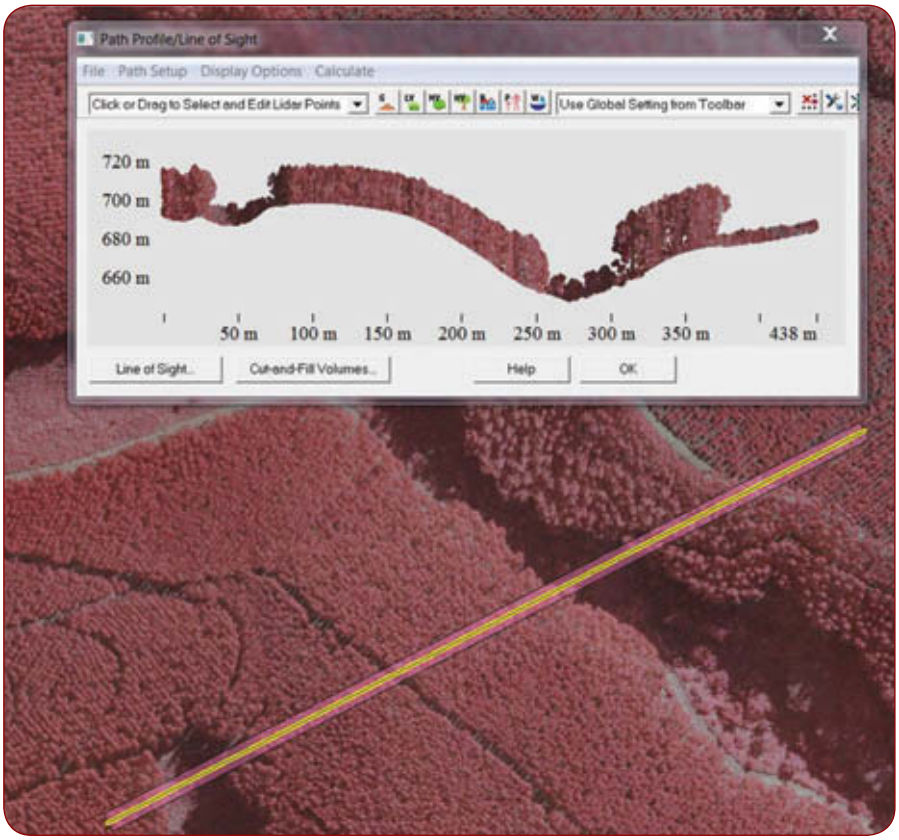

Fig. 2: Cross-sectional view of a point-cloud showing tree height in a plantation.

Automatic feature extraction for buildings and trees

Similar to the ground detection procedure, a second automatic classification function recognises non-ground points. Based on the relationship of a particular point to each of its neighbours, a point may be reclassified as being part of a building (recognised as an array of points sharing the same plane elevated by a specified height above the adjacent ground points) or as high vegetation or trees (recognised as a random array of points above a specified height from the ground). The lidar module even includes a tool to create 3D building and tree models derived from this classification.

Automatic assignment of RGB values

Overlaying a point-cloud on any satellite or aerial image provides an option to apply the RGB value to each point from the corresponding pixel in the imagery. This not only provides a photo realistic model of the features in the dataset when viewed in the application's 3D window, but it also offers the means to query selected RGB values for the purpose of applying a classification based on each point's visual characteristics. For instance, if all of the roofs in a particular area are of the same colour, the corresponding points can be quickly selected and reclassified as buildings. The value inherent in any dataset is fundamentally tied to its compatibility with the specified workflow or output requirements. This is especially true of lidar data, in which incorrectly or inappropriately classified points can render the data useless. The powerful data processing functionality in the lidar module ensures that every point in a point-cloud can be utilised for a specific purpose and genuinely erroneous points can be quickly and easily removed.

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