Design of a Semi-Automated Lidar Point Classification Framework

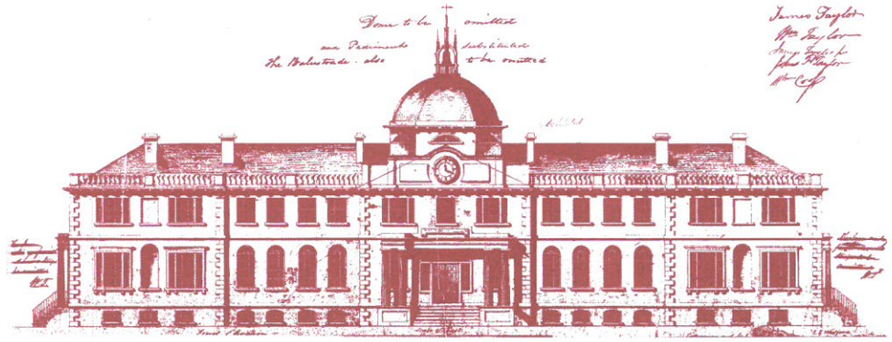
Abstract

Data from airborne light detection and ranging (LiDAR) systems are becoming more commonplace and are being used in applications other than traditional remote sensing and GIS applications, such as for archaeological surveys. However, non-expert LiDAR users face challenges when working with LiDAR data or derived products. Anecdotal evidence suggests that many users may not have much knowledge of how a LiDAR product was derived or the qualities of the original LiDAR point cloud. In addition, suitable processing software may not be accessible due to cost or may require extensive training and familiarity with the tools for users to achieve their desired results.

This thesis addresses some of the challenges non-expert LiDAR users may face by developing a semi-automated point classification framework that does not require expert user input to classify individual points within the point cloud. The Canadian Airborne LiDAR Acquisition Guideline, released by Natural Resources Canada in 2014, was used as a guide in the development process. The framework consists of a multi-stage classification process that can be applied using LiDAR point clouds exclusively or using LiDAR data integrated with other types of data. Code developed as part of this thesis to implement the framework is hosted in a repository on Bitbucket.

The first stage is a ground point identification process that requires little or no operator input to classify ground points within a LiDAR point cloud. It achieved greater than 95% accuracy in sample tests, as compared to available classified ground data. Subsequent stages add or refine classification of points within the point cloud. If only LiDAR data are used, points are classified as building/structure, low vegetation, medium vegetation, high vegetation, unpaved ground, road or paved surface, or points above paved surface. Points that do not meet the criteria for any of the classes are left unclassified. Additional data can be introduced at any stage to improve processing time; add classes, for example, water; or refine results.

Recommendations for future research include making greater use of 3D data structures, making greater use of point level information, and improving methods used to refine classification results.



Home of the School of Graduate Studies, Sir Howard Douglas Hall was designed by J.E. Woolford in 1825 and is the oldest university building in Canada still in use.

UNIVERSITY OF NEW BRUNSWICK

SCHOOL OF GRADUATE STUDIES

ORAL EXAMINATION

Krista Amolins

IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Ph.D. Candidate

Krista Marija Amolins

Graduate Academic Unit

Geodesy & Geomatics Engineering

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Head Hall
Room E-11

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Examining Board:

Dr. David Coleman (Geodesy & Geomatics Eng.)	Supervisor
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2008-2016	PhD candidate, University of New Brunswick
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Publications:

Amolins, K., Y. Zhang, and P. Dare (2007). "Wavelet based image fusion techniques – An introduction, review and comparison." ISPRS Journal of Photogrammetry and Remote Sensing, Vol. 62, No. 4, pp. 249-263.

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Brooks, R., T. Nelson, K. Amolins, G.B. Hall (2015). "Semi-automated building footprint extraction from orthophotos." Geomatica, Vol. 69, No. 2, pp. 231-244.

Conference Presentations

Amolins, K., Y. Zhang, and P. Dare (2008). "Classification of LiDAR data using standard deviation of elevation and characteristic point features." Proceedings of the IEEE International Geoscience and Remote Sensing Symposium 2008 (IGARSS 2008). Boston, Massachusetts, U.S.A., 6-11 July, Vol. 2, pp. 871-874.

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