EuroSDR
European Spatial Data Research

Point cloud processing with laser scanning

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Target audience: Staff of national mapping agencies, researchers, academics, students, private companies

Prerequisites: Familiarity with the basic understanding of Remote Sensing and Surveying. There are separate exercises in module 3 and 4 for those having backgroup in computer science and those wanting tol learning widely basic principles (surveying background but not programming).

Course objectives: Today, there is a large number of mobile and airborne laser scanning point clouds acquired with large number of different systems, such as hand-held, backpack, undercanopy and above canopy drones, and drone systems. Laser Scanning has become a stardard tool for providing 3D of surrounding environment in non-built and built environments. This course will provide understanding how such point clouds could be processed into informatics. Introduction is given to laser scanning physics, general point cloud processing techniques, and then more focus is given to AI, namely machine-learning and deep-learning approaches in point cloud processing. Several applications are covered. Many examples are coming from forestry, where laser scanning has already revolutionized traditional works.

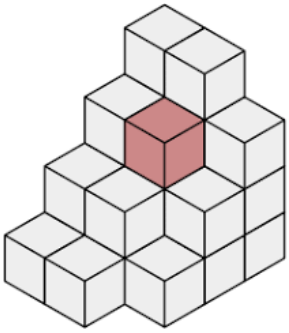
Topics tackled: Lecture at KU Leuven will provide introductory to understand point cloud processing broadly with laser scanning. It will also give understanding of algorithmic thinking for those not working with computer science. More detailed focus is given to change detection with point clouds, and machine/deep learning – type object detection.

Module 1: Understand of laser scanning and related physics

This introductory module refreshes the basic concepts of ALS and MLS including multispectral and single-photon LS from various platforms, positioning using IMU and GNSS, Simultaneous Localization and Mapping (SLAM), and map matching/High-definition maps. MLS platforms includes: a) phone-based scanning, b) vehicle-based scanning, c) drone-based scanning, d) hand-held, backpack and other personal laser scanning techniques. Physics of intensity is discussed.

Basic processing of data into DEM, DSM, nDSM/CHM is covered. Module material covers articles related to these topics. Module exercise is based on multiple-choice questions from related articles.

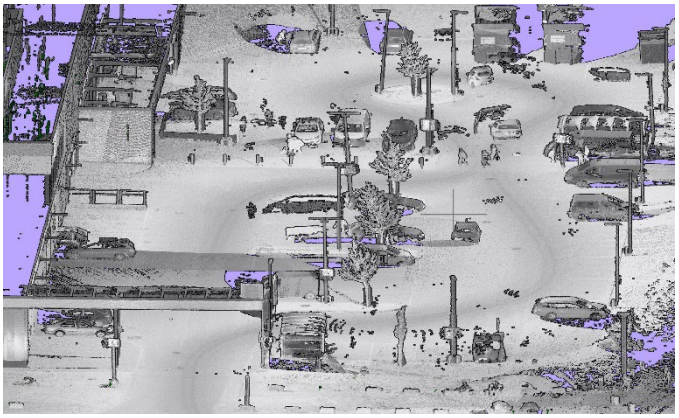
Module 2: Algorithmic thinking with laser scanning



After module 1, participants understands working principle of laser scanning data. Algorithmic thinking is then exercised in Module 2. Basics of data processing (data types, common approaches, clustering/segmentation, use of temporal data, flow charts, computational cost, point cloud matching, change detection, classification of points, heuristic algorithms, common computer vision tools) are covered. Module material covers articles and slides related to these topics. Module exercise is based on multiple-choice questions from related articles.

Module 3: Basic algorithms with point cloud processing

After module 2, participants have a good, basic understanding how laser scanning data can be turned into informatics. In this module more details of specific algorithms are studied. Change detection, coarse registration, feature extraction and classication of objects is covered. Module material covers articles and slides related to these topics. Module exercise has two options: 1) writing a 2 page-long review of selected, algorithmic topics, or 2) carrying out a small change detection tasks.



Module 4: Advanced algorithms with point cloud processing

Module 4 enlarges the point cloud processing knowledge of the participant more into the use of machine learning and deep learning. Module material covers articles and slides related to these topics. Module exercise has two options: 1) writing a 2 page-long review of selected, algorithmic topics, or 2) carrying out a small DL/ML exercise.