Using R as an environment for automatic extraction of forest growth parameters from terrestrial laser scanning data

Hans-Joachim Klemmt[a]

[a]*Chair of Forest Growth and Yield, Technische Universität München, Am Hochanger 13, 85354 Freising*
(h-j.klemmt@lrz.tum.de)

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Laser scanning becomes a more and more important measurement technology in forests. Meanwhile the applicability of airborne laser scanning systems (ALS) for forestry measurement purposes is far advanced [3, 7]. So far ALS-systems mainly concentrate on the extraction of tree height parameters. To describe the structure of forests additional parameters are needed. Terrestrial laser scanning provides very quick information on the structure of forests in form of 3D-point clouds, which are processed to gain such taxation features as the number of trees in a stand, geoposition of individual trunks, diameters at breast height (DBH), crown base height and height of trees [2, 9].
So far unfortunately no software solution exists which extracts the requested parameters automatically from terrestrial 3D data. To eradicate this flaw at the Chair of Forest Growth and Yield at Technische Universität München a working group has been installed which is concerned with this topic. This working group uses R [8] to extract the relevant parameters from 3D-data. R is used because it is a GPL-licensed, Open Source solution for statistical computing which is well-resourced with various packages for clustering-purposes as well as for image processing and visualization. One big advantage of R is also the connectivity with other software like WEKA [5].
To this day a system is developed which separates automatically data sets, which belong to the ground or soil layer, from potential vegetation points. Trees are detected in vegetation point cloud by application of several cluster algorithms. Forest parameters like DBH are calculated by application of Hough-Transformation. Visualization in R is done by the use of standard output as well as by the use of the OpenGL-extension in the package RGL [1].
Although R is an interpreted computer language, which seems to be a big disadvantage for this aim because of the huge number of data sets to process [6], the promising results of the development have shown that it is possible to extract automatically forest growth parameters with a high accuracy and a high level of accordance to manual measurements by the use of this language. Further work aims on the development of a R-based software framework in combination with a JAVA visualization component for the automatic extraction of forest growth parameters from terrestrial laser scanning data.

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