Topic M16:

Reconstruction of the trajectory of a moving laser scanner: Test of algorithms using virtual tree stands and virtual scans

Let us assume a laser scanner, generating a 3-d point cloud of its environment in regular time intervals, is moved within a tree stand (or flying above a canopy, installed on a drone), but its GPS is not working or gives no reliable results. So a lot of scans is obtained for each second, i.e., we have a time series of point clouds, but the positions and exact orientations of the laser scanner during its movement are not known.
A possible solution consists of analyzing each scan, finding corresponding points among consecutive scans, and reconstructing the trajectory based on this information. There exist already several algorithms for this task.
The goal of this project is to utilize artificial tree stands, simulated on the modelling platform GroIMP (Kniemeyer 2008) and scanned with the virtual laser scanner which is already available in GroIMP, to test and benchmark several of these algorithms. It should also be analyzed if and how the structure of the 3-d scene (type of tree stand) influences the quality of the results of the algorithms.

Co-supervision by PD Dr. Peter Surový (Czech University of Life Sciences).

Literature:

Fabio, R. (2003): From point cloud to surface: the modeling and visualization problem. International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences 34-5W10.

Kniemeyer, O. (2008): Design and Implementation of a Graph Grammar Based Language for Functional-Structural Plant Modelling. Ph.D. thesis, University of Technology at Cottbus. http://nbn-resolving.de/urn/resolver.pl?urn=urn:nbn:de:kobv:co1-opus-5937

Wikipedia page: https://en.wikipedia.org/wiki/Simultaneous_localization_and_mapping (last access: 10 March, 2021).

M.Sc. thesis for 1 candidate from "Angewandte Informatik", "Data Science", or "Forstwissenschaften und Waldökologie" with focus on Ecosystem Analysis and Modelling.