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Individual Tree Crown Segmentation from Airborne Laser Scanning Data

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Rapid development of remote sensing technology, especially in spatial resolution, allows working with individual trees in forest scenes. Structural information about individual trees is important in forestry for inventory purposes. Radiative transfer models used for quantitative assessment of forest stands also require three-dimensional models of individual trees. Airborne laser scanning (ALS) point clouds acquired over forest sites bears these kinds of 3D information.

There are many segmentation approaches described in literature, e. g. valley following, region growing, pouring / watershed, template matching, clustering — just to mention several of them. Some of the algorithms were originated in earlier times and are based on optical imagery; some of them are newer and are suited well to the structures of ALS point clouds.

The main objective of the study is to compare the results from several approaches to segmentation of individual tree crowns on our practical data sets. Robustness is an important factor to be studied. Most of the approaches can be site-specific in some way and the Czech forests are not the same as Canadian or Scandinavian ones, because of species and structural composition.

For the testing purposes we work with ALS data with medium to high density (Riegl Q680i instrument, 10-50 points / m2) acquired over spruce and beech forests situated in mountainous areas in the Czech Republic.

In addition to comparison of segmentation approaches from literature we propose a combined algorithm based on region growing with an active contour serving as a crown boundary. It leads to an advantageous behaviour dealing with a mixed forest of different tree age.
Assessment of results is based on reciprocal comparison of different algorithms and also on validation against ground truth. Two accuracies are estimated: 1/ for detection phase, 2/ for delineation phase.