A Comparison of LiDAR and Image-derived Canopy Height Models for Individual Tree Crown Segmentation with Object Based Image Analysis

P. Tompalski, P. Węzyk, M. Weidenbach, R. de Kok, P. Hawryło

Outline

- Individual tree based forest inventories rely on accurate tree crown delineation

- Most algorithms are designed to work on ALS data or images only

- Recent improvements in stereomatching-based Crown Height Models (CHMs) allow to use them to extract various stand characteristics.
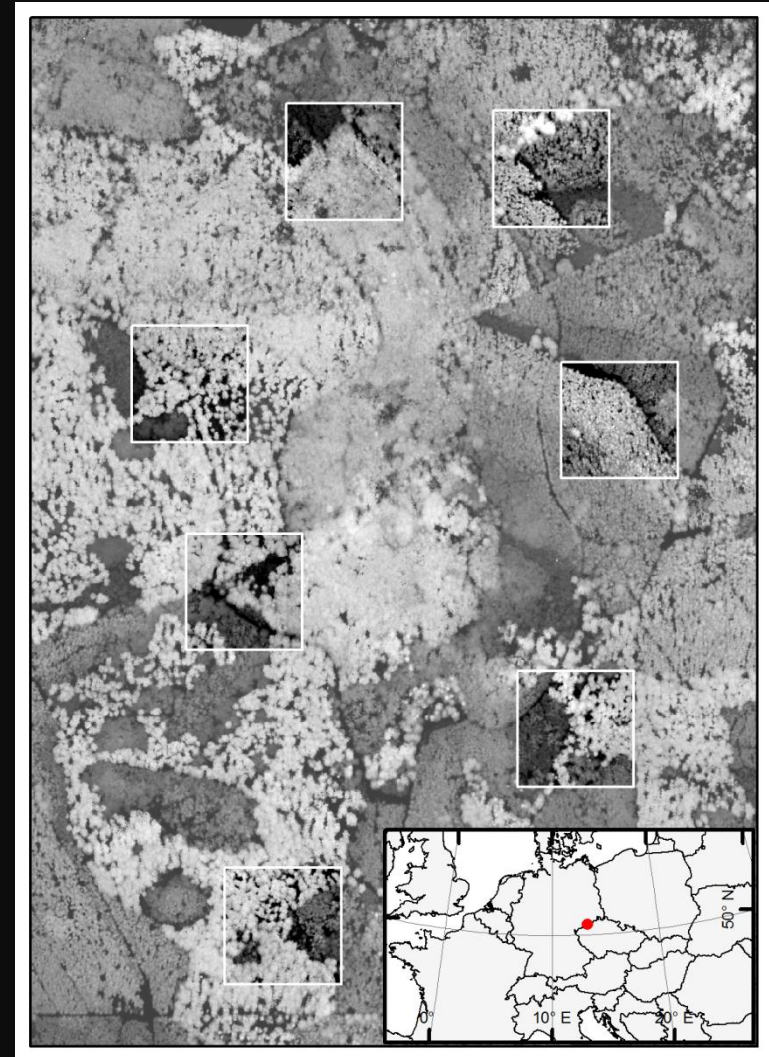
Objective

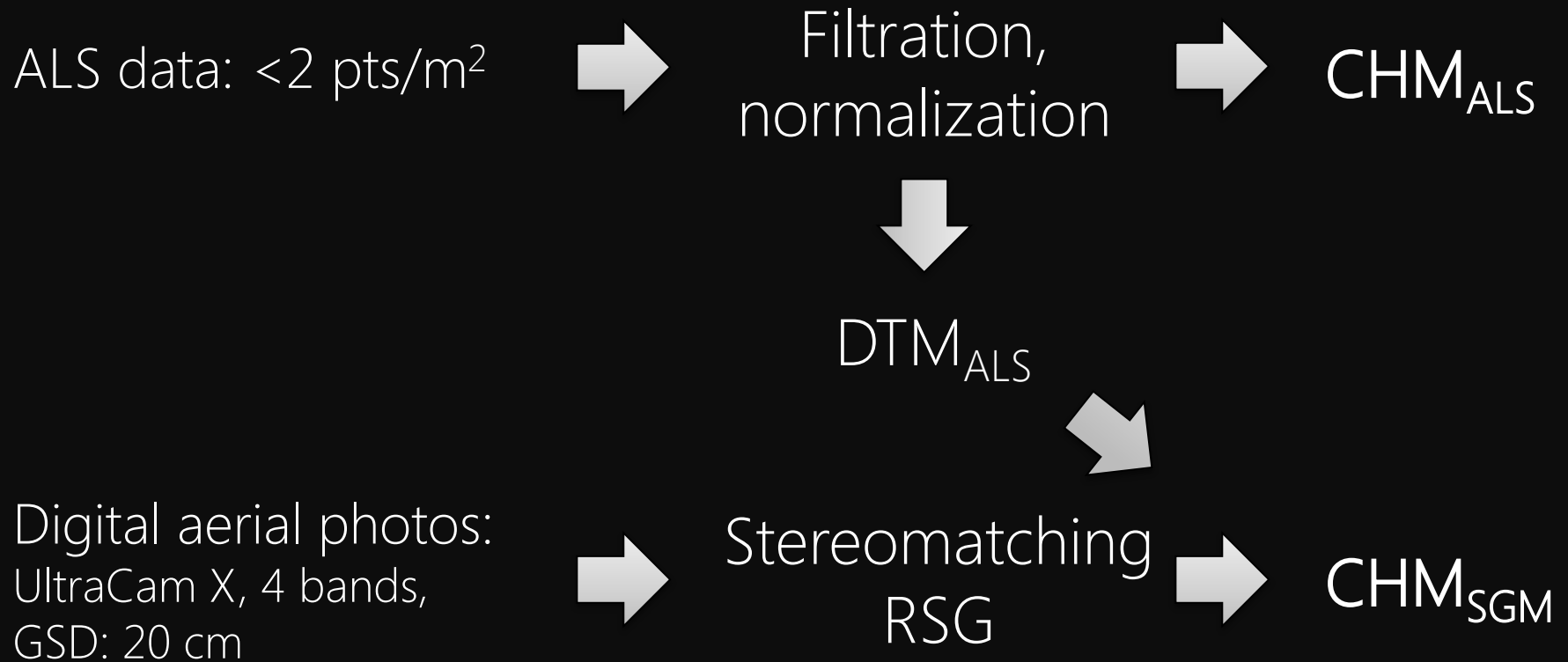Universal and self-adapting algorithm for single tree crown delineation.

The algorithm should be accurate in various stand types and conditions, (tree species composition, age, height, tree density) and applicable to different types of input data (canopy models).

Methods

- Study area: East Germany, Saxony

- Dominating tree species: Norway spruce

- Ground truth data 200 x 200 m plots (Sachsen Forst);
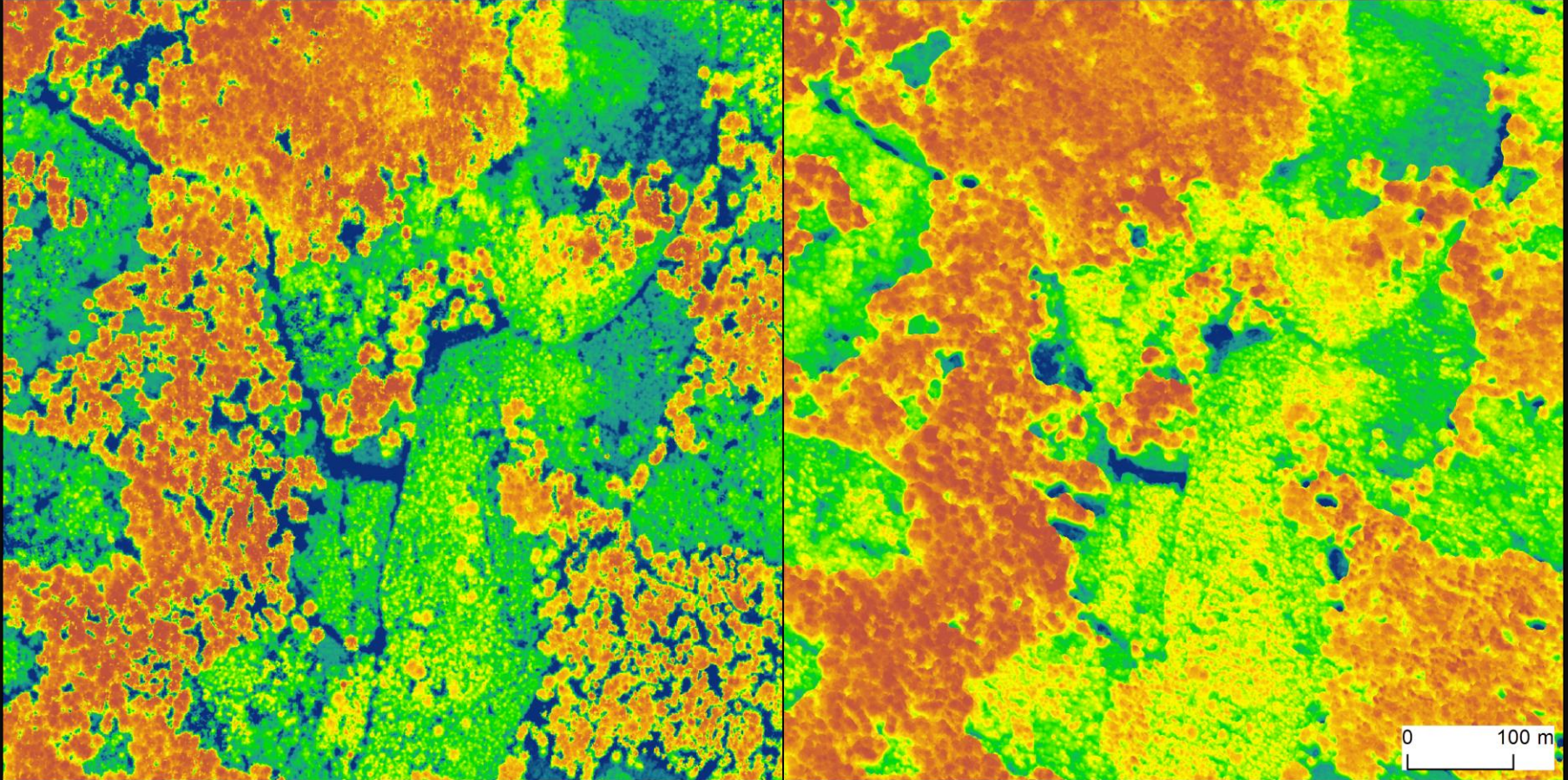
- Various stand conditions

Methods

ALS data: <2 pts/m^2 ➡ Filtration, normalization ➡ CHM$_{ALS}$

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DTM$_{ALS}$

Digital aerial photos:
UltraCam X, 4 bands,
GSD: 20 cm ➡ Stereomatching RSG ➡ CHM$_{SGM}$

Challenge

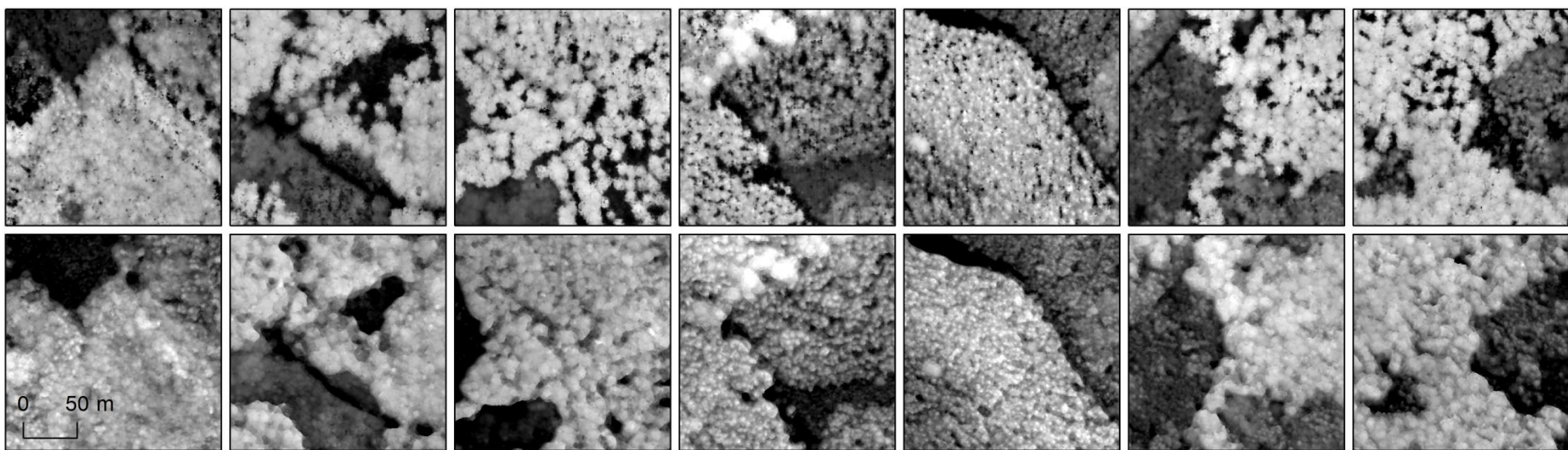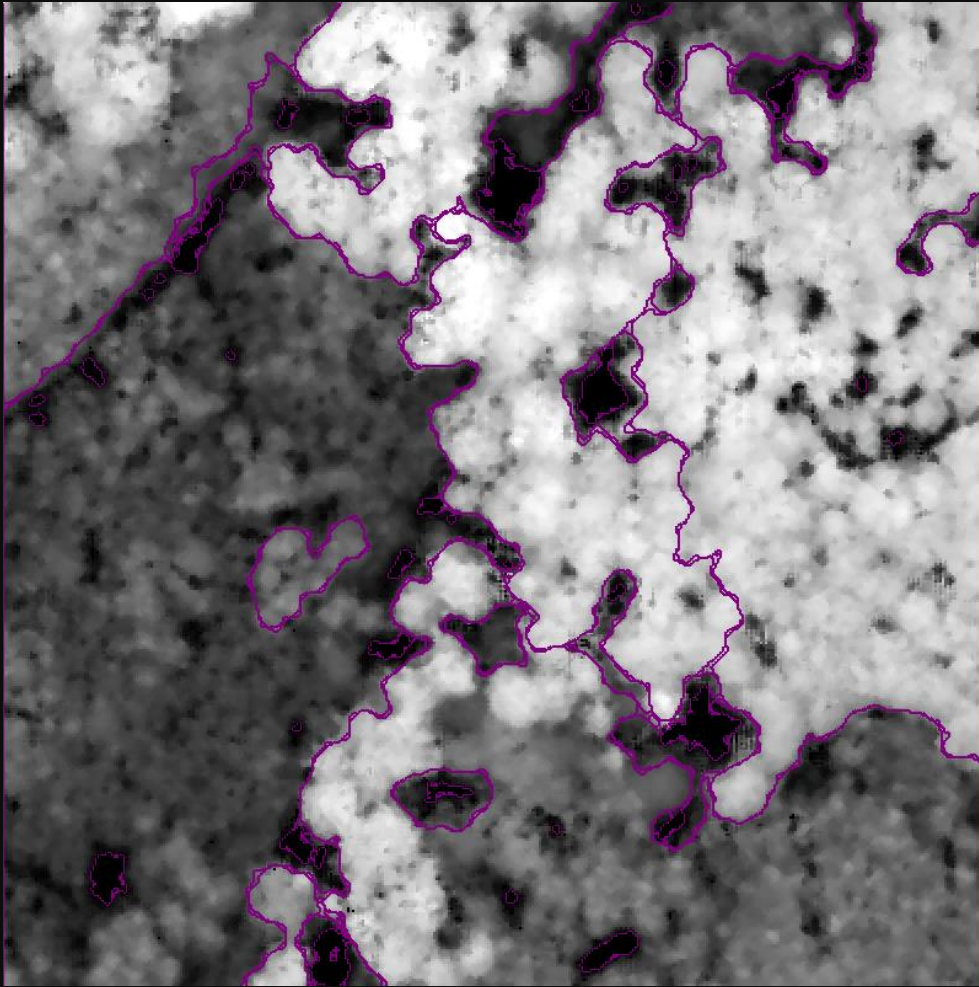CHM_{ALS} VS CHM_{SGM}
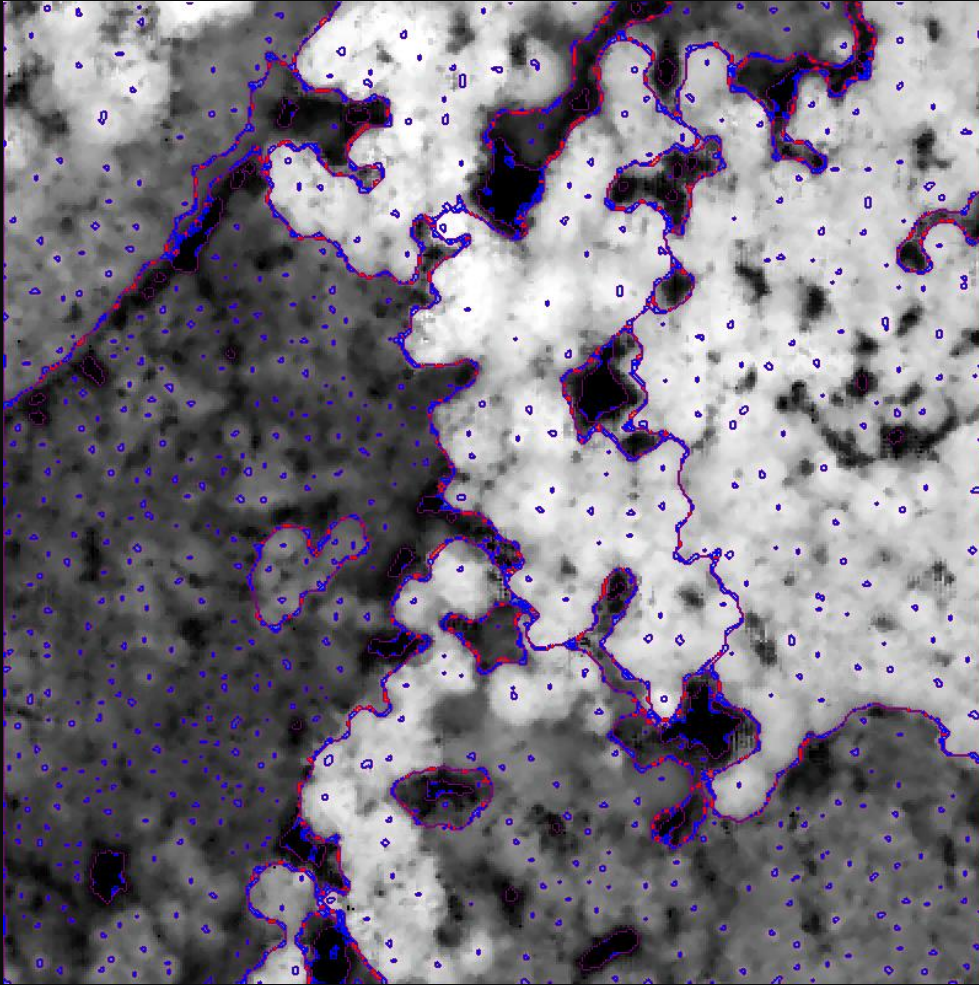
CHMs

ALS-derived

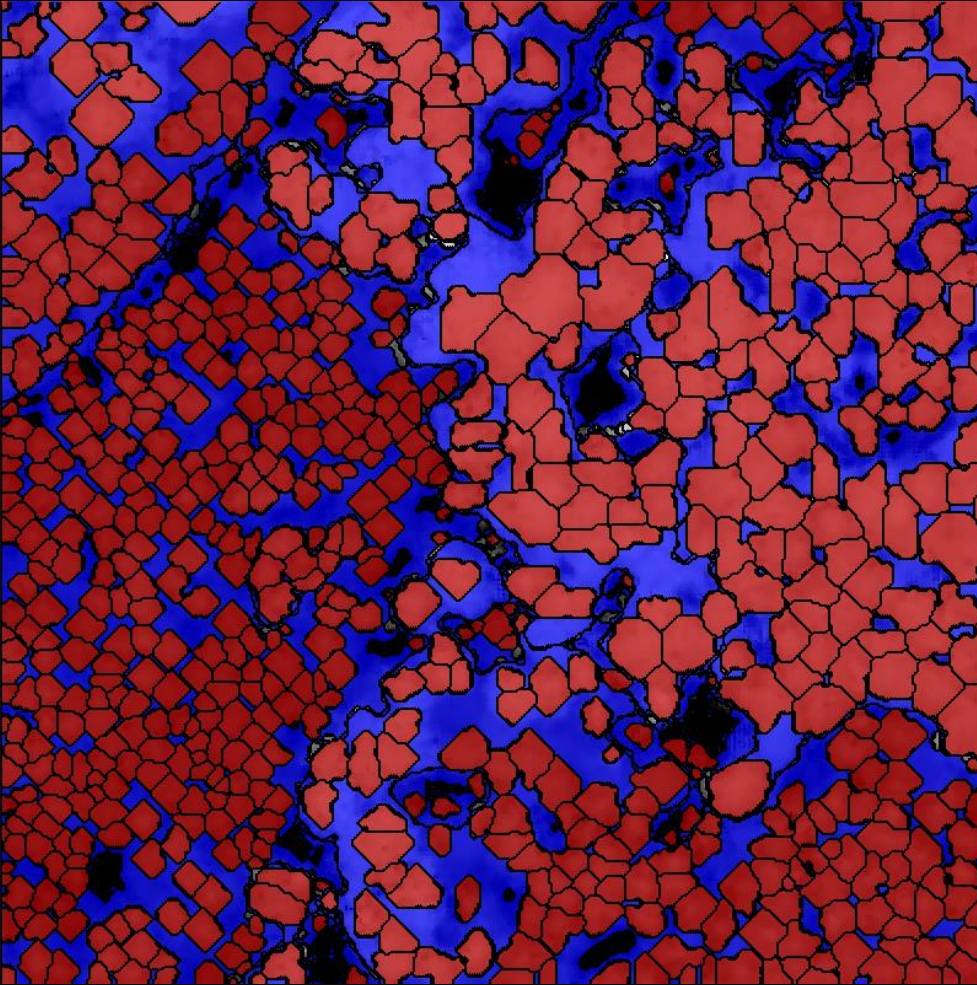SGM-derived

Step 1: homogeneous stand groups

- Segmentation based on tree height
- Allows to proces each part of forest stand using different parameters
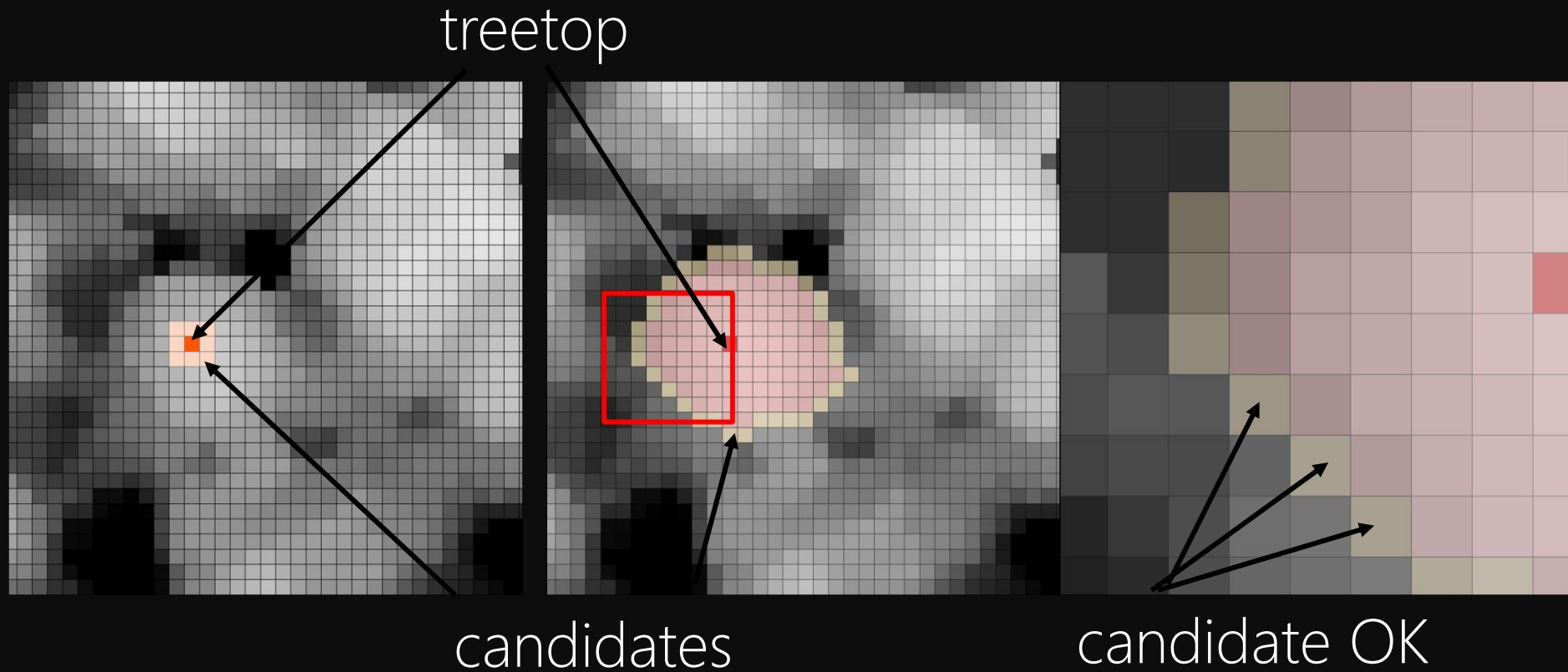
Step 2: finding local maxima

- Treetops are detected for each stand group separatelly
- Treetops to close to each other are filtered out
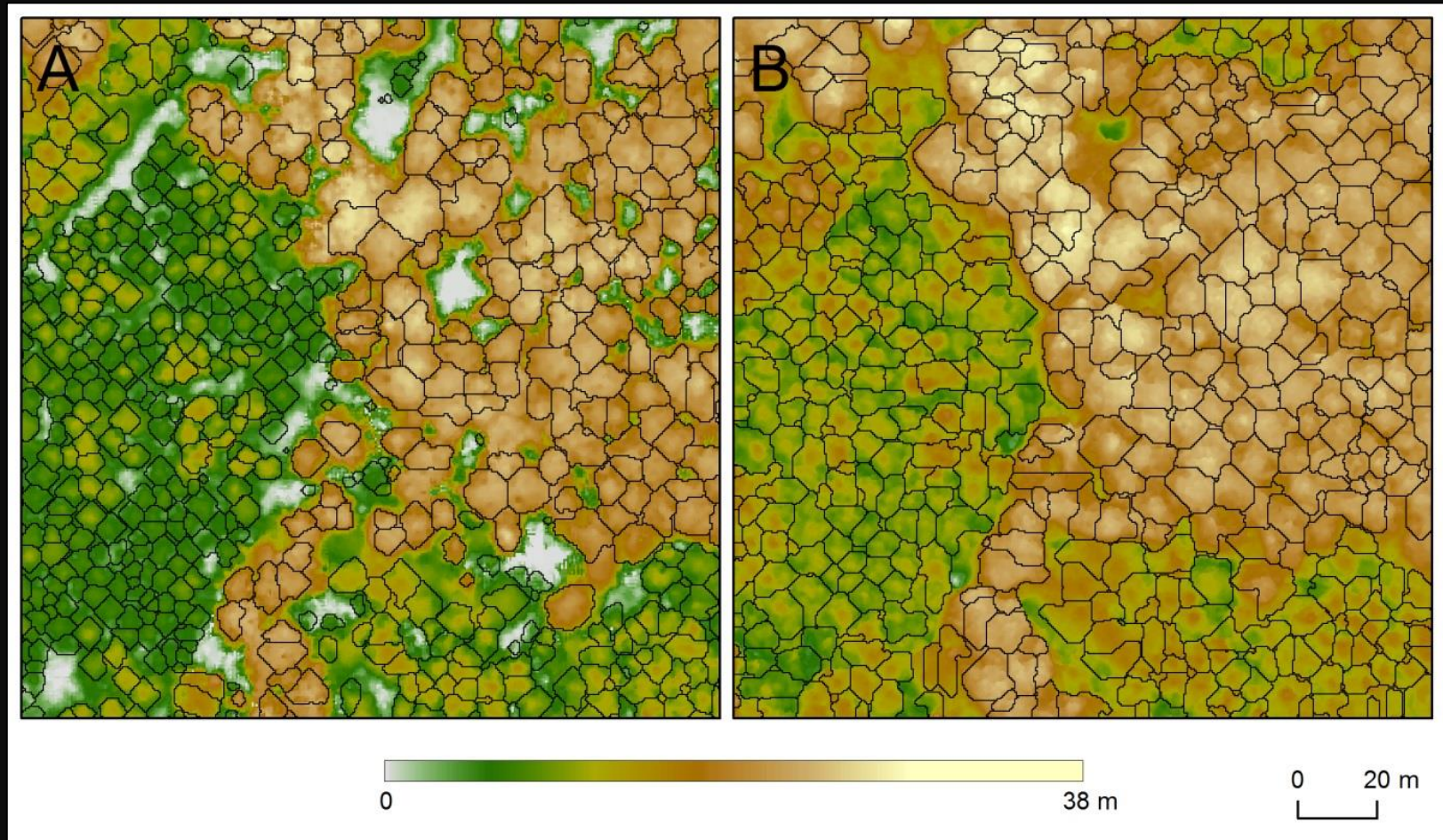
Step 3: tree crown delineation

- Each treetop (seed) is growing separately

- Limits: size, shape, height differencee, other crowns
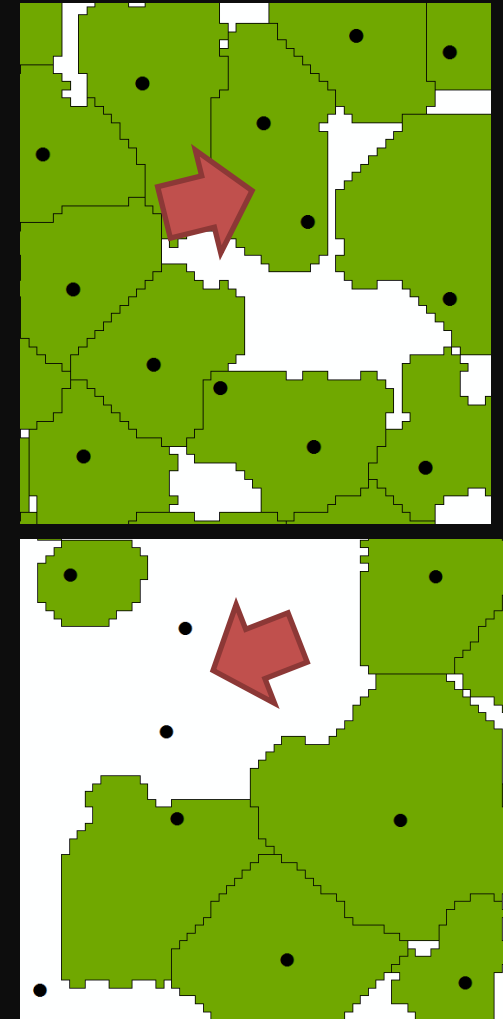
Step 3: Details

treetop

candidates

candidate OK

Results

Results

	ALS-based	SGM-based
1 to 1	90.10%	74.10%
more than 1 treetop	2.90%	14.30%
crowns not detected	6.80%	11.50%

Conclussions

- CHM$_{ALS}$ is more suitable for crown delineation. CHM$_{SGM}$ is to smooth and does not represent smal gaps in the canopy correctly

- Initial division into stand strata groups is crucial for achieving reliable results across different forest stand conditions

- The accuracy of crown delineation depends much more on the data quality than on the methodological aproach itself

Thank you!

- Questions? Comments?
  Please contact Piotr Tompalski PhD:
  piotr.tompalski@forestry.ubc.ca

- Partners:
  University of Agriculture in Krakow, landConsult.de,
  ProGea Consulting