Multi-3D-window dead tree detection of dead standing Eucalyptus camaldulensis from voxelised full-waveform LiDAR data for tackling height differences in native forests

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Introduction

For tackling tree height variations while working with native forest, this study adds on existing knowledge by introducing the usage of multi-scale 3D-windows for extracting composite structural information of dead standing Eucalypt trees. The structural information and the multi-scale 3D-windows are used to detect dead standing Eucalypt trees without tree delineation.

Materials

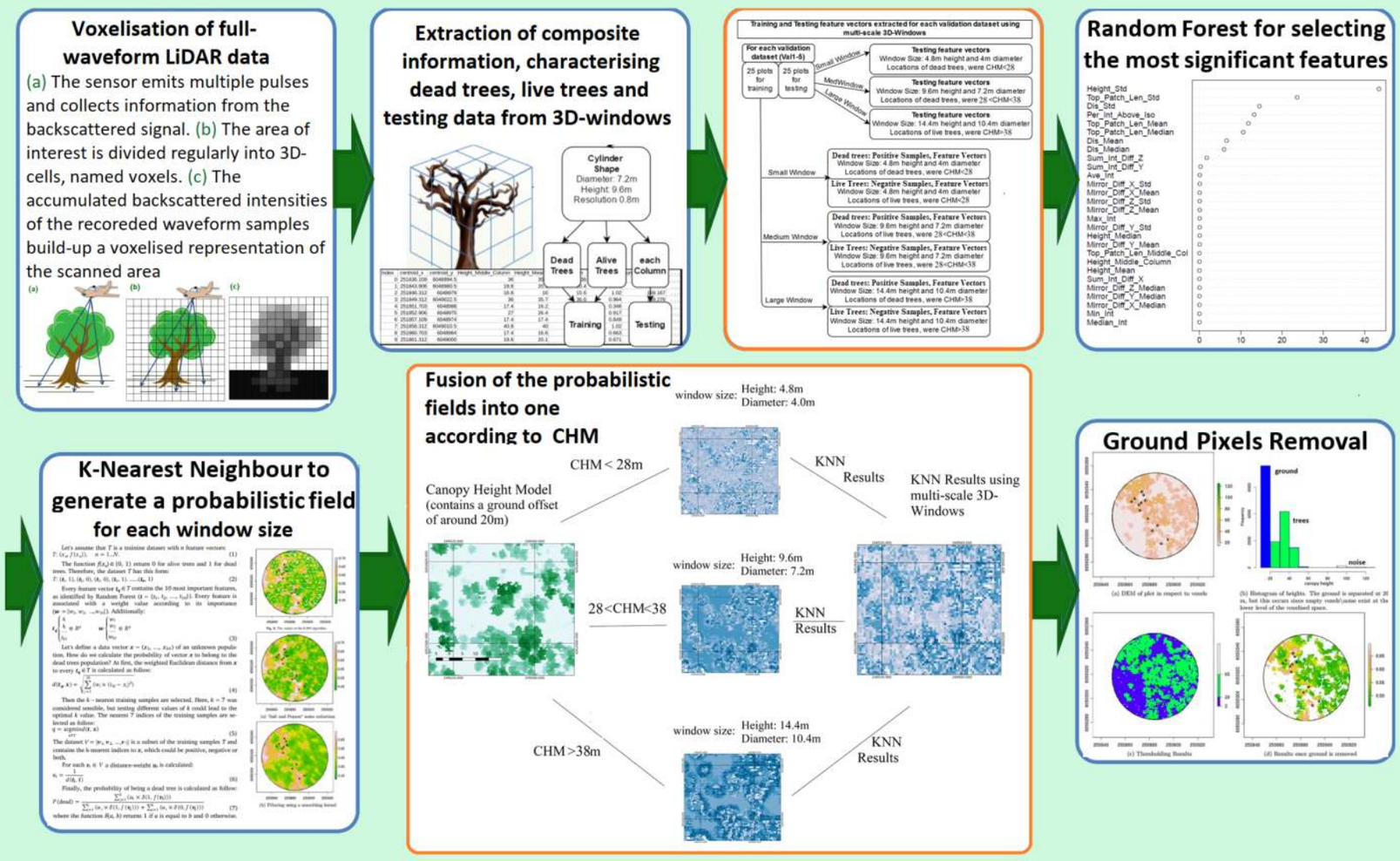
Study area is a native River Red Gum (Eucalypt camaldulensis) forest of size 95,196 ha2 in south-eastern Australia.

Full-waveform LiDAR acquired from 6th to 31st of March, 2015, with average footprint spacing 4:3 per m2, including flight overlapping

Field data collected in July 2015. They contain in-situ measurements from about 2386 trees of which 260 are dead.

Methodology

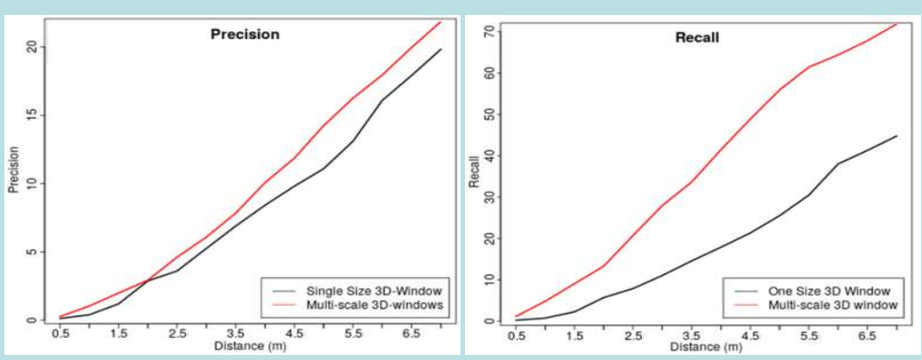
The following figures gives an overview of the proposed processing pipeline. For comparison and validation purposes, two approaches were implemented: one approach uses a single 3D-window for extracting structural features, while the new multi-scale methodology uses three 3D-windows of different sizes.



Results

The results have been cross-validated by randomly dividing the field data into training and testing samples four times.

The new approach improved both precision (TP/(TP + FP)) and recall (TP/(TP + FN)) of the prediction by 2.1% and 27.6% respectively.



Conclusions

This study showed that the usage of multi-scale 3D-windows for tackling tree height variations, while extracting parameters from native forests, improves prediction. This opens ups possibilities of new research directions and applications related to the proposed methodology for deriving forest related parameters (e.g. biomass and leaf area index).

Acknowledgements

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Reference

Miltiadou et al. (2019) Multi-scale 3D cylindrical windows for tackling height variations while detecting dead standing Eucalypt trees without tree delineation from voxelised full-waveform LiDAR data (under review)