Detection of Dead Standing Trees using DASOS's new features

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This paper presents a new feature of DASOS, which is an open source software for managing full-waveform (FW) LiDAR data and that feature is used for detecting dead standing Eucalypt in native Australian forests.

The value of dead standing Eucalypt trees from a biodiversity management perspective is large. In Australia, many arboreal mammals and birds, which are close to extinct, inhabit hollows [2]. Nevertheless, studies predict shortage of hollows in the near future due to tree harvesting and the decades required for a tree to be mature enough to develop a hollow [4] [3]. Dead standing eucalypt trees are more likely to be aged and have hollows, therefore automated detection of them plays a significant role in protecting animals that rely on hollows.

The LiDAR data used for that project are provided by RPS Australia East Pty Ltd and they were collected in March 2015 using the Riegl (LMS-Q780 or LMS-Q680i?) sensor at an Australian native Forest with eucalyptus. The Riegl LMS-Q??? is a native full-waveform sensor and the LiDAR point clouds were generated from the waveform instrument data during post processing. In addition, the field plots used for the classifications are provided by (Interprine Group Ltd or Forest Corporation?) and contain around 1000 eucalyptus trees with diameter breast height greater than 20cm while 10% of them are dead.

The new feature of DASOS calculates forestry metrics within a radius relevant to canopy height and exports all metrics into a single raster for fast interpretation in advanced statistical tools. Traditional ways of interpreting FW LiDAR data, suggests extraction of a denser points cloud using Gaussian decomposition [5] [7], but as mentioned before with the Riegl system this is done at post processing. Nevertheless DASOS was influenced by Persson et al, 2005, who used voxelisation to visualise the waveforms [6], but DASOS also uses it for generating metrics. It further normalises the intensities so that equal pulse length exists inside each voxel, making intensities more meaningful. Further, recent publication on tree species classification showed that voxelisation could confer good results while interpreting FW LiDAR data [1].

In this project, the new feature of DASOS is used for generating 3D signatures characterising dead standing trees. Then, Random Forest is applied for comparing the LiDAR points clouds and the the FW LiDAR data.

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References

[1] L Cao, N.C Coops, L.I. Innes, J. Dai, and H Ruan. Tree species classification in subtropical forests using small-footprint full-waveform lidar data. 2016.

[2] Lindenmayer D. Gibbons P. *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing, 2002.

[3] R. L Goldingay. Characteristics of tree hollows used by australian birds and bats. *Wildlife Research*, 36(5):394–409, 2009.

[4] D. B. Lindenmayer and J. T. Wood. Long-term patterns in the decay, collapse, and abundance of trees with hollows in the mountain ash (eucalyptus regnans) forests of victoria, southeastern australia. *Canadian Journal of Forest Research*, 40(1):48–54, 2010.

[5] A. Neuenschwander, L. Magruder, and M. Tyler. Landcover classification of small-footprint full-waveform lidar data. *Jounal of Applied Remote Sensing*, 3(1):033544–033544.

[6] A. Persson, U. Soderman, J. Topel, and S. Ahlberg. *Visualisation and Analysis of full-waveform airborne laser scanner data*. V/3 Workshop, Laser scanning 2005, 2005.

[7] J. Reitberger, P. Krzystek, and U. Stilla. Analysis of full waveform LiDAR data for tree species classification. *International Journal of Remote Sensing*, 29(5):1407–1431, 2008.