DSAIL
SOLVING REAL WORLD PROBLEMS

Automating Tree Inventory with Stereoscopic Vision

Forest inventory involves collecting and organising forest data, usually measurements, for further downstream analysis. Tasks are repetitive and cumbersome.

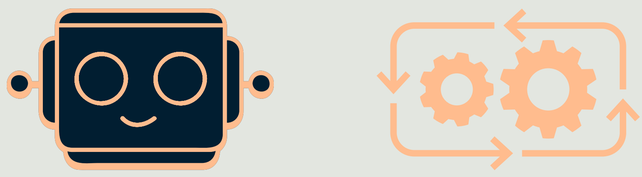


RESEARCH PROBLEM

Terrestrial Laser Scanning (TLS) and Structure from Motion (SfM) cannot perform tree biophysical parameter estimation in real time due to computational cost. TLS equipment is also very expensive.



Good accuracy, low cost, and reduced amounts of data processing required post field surveys are desirable.



Good candidate for automation

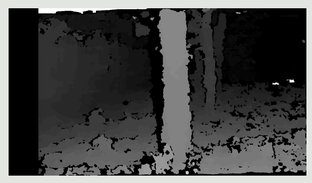
PROPOSED APPROACH

We capture stereoscopic images of trees using a stereo (depth) camera and obtain a depth map from a pair of stereo images. It tells us how far from the camera points in the image area



We perform tree trunk segmentation using a pretrained deep learning model





We apply multiple view geometry techniques to compute the diameter of the tree trunk at breast height (1.3m above trunk base)

RESULTS & DISCUSSION



Accuracy of the system depends on the camera resolution and the distance of the tree from the camera

Not suitable for use in stands with dense undergrowth as in natural forests. Highly suited to plantation forests.

90 Trees

R^2 0.9650

RMSE 1.70 cm





Segmented tree trunk (left) & segmented depth map (right)

APPLICATIONS

Large-scale automated tree inventory with autonomous mobile robots (rovers) or UAVs fitted with such a vision system



Mobile robot with depth camera
Source: Robotshop.com

Robotic tree harvesting where selective harvesting based on trunk diameter is practiced.



Menzi Muck M545 tree harvester
Source: menzimuck.eu

READ MORE ABOUT OF THIS PROJECT

INFO

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