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[Volume XL-5](#)

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-5, 87-92, 2014
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-5/87/2014/
doi: 10.5194/isprsarchives-XL-5-87-2014

A feasibility study on the measurement of tree trunks in forests using multi-scale vertical images

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Keywords: Photogrammetry, Orientation, Matching, Circle Fitting, Fisheye, Bundle Adjustment

Abstract. The determination of the Diameter at Breast Height (DBH) is an important variable that contributes to several studies on forest, e.g., environmental monitoring, tree growth, volume of wood, and biomass estimation. This paper presents a preliminary technique for the measurement of tree trunks using terrestrial images collected with a panoramic camera in nadir view. A multi-scale model is generated with these images. Homologue points on the trunk surface are measured over the images and their ground coordinates are determined by intersection of rays. The resulting XY coordinates of each trunk, defining an arc shape, can be used as observations in a circle fitting by least squares. Then, the DBH of each trunk is calculated using an estimated radius. Experiments were performed in two urban forest areas to assess the approach. In comparison with direct measurements on the trunks taken with a measuring tape, the discrepancies presented a Root Mean Square Error (RMSE) of 1.8 cm with a standard deviation of 0.7 cm. These results demonstrate compatibility with manual measurements and confirm the feasibility of the proposed technique.

[Conference Paper](#) (PDF, 646 KB)

Citation: Berveglieri, A., Oliveira, R. O., and Tommaselli, A. M.G.: A feasibility study on the measurement of tree trunks in forests using multi-scale vertical images, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-5, 87-92, doi:10.5194/isprsarchives-XL-5-87-2014, 2014.

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