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Wood-leaf separation from terrestrial LIDAR point clouds in a Quercus ilex L stand

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Information on forest canopy structure is required at a wide range of spatial scales for several environmental applications such as ecosystem productivity model, ecological and forest management, disease and stress detection, fuel properties etc.
Recent applications of Terrestrial Laser Scanner (TLS) have been directed to detailed description of the canopy structure. However, the accuracy and applicability of TLS techniques for canopy characterization of broadleaf evergreen forests needs further investigations. In particular, estimation of tree attributes such as, canopy density, crown bulk density, branch size distribution etc. in evergreen plants presupposes a correct separation between points representing woody material, leaves and small branches.
The main objective of this research was to improve the estimate of woody material volumes in evergreen broadleaf tree species by developing a method for separating wood points from leaf points. In particular, in this study, a simple approach, previously developed to discriminate wood and foliage from a single tree, was tested at plot level.
The study was carried out in the South-East area of Sardinia, Italy. The area was covered by Broadleaf forests dominated by Oak (Quercus ilex) with associated species consisting of Arbutus unedo, Erica arborea, etc. Destructive and non-destructive measurements were done inside two circular plots of 10 m radius. TLS data sets were also collected in field by multiple scanning of the two plots.
To handle the large number of points, after using noise reduction filters point, clouds were partitioned in cubic volumes (voxels) that were used as basic volume elements for processing TLS measurement. A density-based clustering algorithm was used for separating wood/non-wood voxels in the point clouds. Clustering process led to the identification of wood and leaf voxels. Points belonging to each voxel were then classified and quantified as wood, foliage and noise. Experimental results show that the segmentation algorithm can discriminate wood and foliage clusters and consequently give the points of cloud associated to foliage, trunk and main branches at plot level, especially when understory layer is dominated by low herbaceous vegetation.