Chestnut burrs detection in UAV aerial imagery

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**Abstract.** In the last years, remote sensing techniques based on unmanned aerial vehicles (UAVs) have been proved to be a valuable tool to acquire extensive data of crops, which are essential for feeding innovative decision support systems aimed at improving growers’ farm management. In this context, the capability to automatically monitor and assess chestnut fields production, exploiting UAV remotely sensed imagery, has been considered a valuable service by farmers to properly plan the harvesting tasks and the pricing. To this aim, a specific mapping system and processing procedure have to be designed, to acquire high-resolution aerial images, merge them to create a georeferenced orthomosaic map and detect chestnut burrs in it.

In this work, an innovative image processing method to automatically detect and count chestnut burrs in RGB aerial imagery is presented. The method is based on a Region Based Convolutional Neural Networks (R-CNN) customized for object detection. The developed method was tested on the imagery of a chestnut field located in Dronero (Piedmont region, Italy). The aerial imagery was acquired on September 2021 at noon, using a MAIA RGB-NIR camera installed on a DJI Matrice 300 RTK drone. The flight altitude was maintained close to 25 meters from the terrain during the whole mission, and the obtained ground sample distance (GSD) was 10 mm. In order to define and label the training and test datasets, a specific software was implemented in the Matlab programming environment, which allows the manual detection of burrs. For this preliminary study, a set of 10 sample trees was selected from the map, and, for each tree, the position and number of automatically detected burrs were compared with manually obtained ones. The accuracy in the burrs detection process was assessed by measuring the number of properly detected burrs, the extension of the image regions wrongly classified as burrs, and, finally, the number of not detected/missed burrs. Results obtained by processing the considered dataset show the feasibility of the proposed approach, which aims at exploiting RGB imagery. The image processing method here presented is an essential phase of a wider research activity, which is aimed at developing a decision support system for chestnut growers, with a particular focus on the growing, yield estimation and harvesting phases.