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The intensity return behavior of the high resolution terrestrial 3D laser

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Remote sensing is a great non-intrusive technology for monitoring vegetation and very helpful for farmers to optimize their crop production. Earth observation can be an important tool in for instance the detection of abiotic and biotic stresses and for orchard management. Satellites and airborne remote sensing sensors are very useful in the monitoring of vegetation, but by creating distance between the sensor and the target, the issue of mixed pixel pops up. The interactions that occur in such a mixed pixel depend on the spectral characteristics of the components that build up the pixel. Vegetation, with its typical 3D structure, will have major impacts on the captured light by a sensor due to its many interactions with the different vegetation elements. Terrestrial or ground based LiDAR (Light Detection And Ranging: a laser scanning device) is a basic tool for deriving vegetation structure information for crop management (e.g. pruning) and as such can help to understand interaction of light with structure.
LiDAR is able to describe and quantify vegetation structure by measuring the phase difference and intensity of light beams. As such, this instrument may help to unravel the impact of the contribution of woody and foliar structure to the light intercepted by a spectral sensor. In this study, the LiDAR FARO LS880 was used. This device also measures an intensity return (IR) and a preliminary analysis was conducted to test how IR can used in a pattern recognition algorithm to determine leaves and woody components.
A measuring set-up was constructed. First, different materials have been scanned perpendicularly to the laser beam at different distances between sensor and target (i.e. range). It was observed that the measured IR range varies with the scanned material. For each material a relation is found between the IR and range. In the IR-range feature space, translation shifts were observed for different textures of materials. Secondly, citrus leaves were scanned in a dark room at different angles. The 3D scanning data is consistent and shows a clear relation between the scanning angle and the measured IR of the leaves.