

Jordi Gené Mola presented the PhD Thesis "Fruit detection and 3D location using optical sensors and computer vision"

Jordi Gené Mola, member of the Research Group in AgrolICT and Precision Agriculture of the University of Lleida (GRAP), defended the PhD Thesis on 8th May 2020. The Thesis is titled "**Fruit detection and 3D location using optical sensors and computer vision**".

The thesis aims to contribute to the development of new methodologies for fruit detection and location by combining optical sensors and artificial intelligence algorithms. In order to minimize variable lighting effects, it is proposed the use of active sensors that work in the infrared light spectrum. In particular, light detection and ranging sensors (LiDAR) and depth cameras (RGB-D) based on the time-of-flight principle were evaluated.

These sensors provide the amount of backscattered infrared light reflected by the measured objects. With

respect to minimizing the number of fruit occlusions, two different approaches were tested: (1) the application of forced air flow; and (2) the use of multi-view scanning techniques, such as structure-from-motion (SfM) photogrammetry. The results have demonstrated the usefulness of the backscattered intensity provided by LiDAR and RGB-D sensors for fruit detection. This supposes an advance in the state-of-the-art, since this feature has not previously been exploited. Both of the strategies tested to minimize fruit occlusions showed an increase in the fruit detection rate. Of all the tested methodologies, the combination of instance segmentation neural networks and SfM photogrammetry gave the best results, reporting detection rates higher than 90% and false positive rates under 4%. This thesis was developed in the frame of the **Research Projects AgVANCE** (AGL2013-48297-C2-2-R, Spanish Ministry of Economy, Industry and Competitiveness) and **PAGFRUIT** (RTI2018-094222-B-I00, Spanish Ministry of Science, Innovation and Universities).

The PhD Thesis was awarded with the maximum **Cum Laude** distinction. The members of the examination board were Dr. Spyros Fountas (Athens University of Agriculture), Dr. Francesc Solanelles (Department of Agriculture, Livestock, Fisheries and Food of the Catalan Government), and Dr. José A. Martínez-Casasnovas (University of Lleida).

