

Automatic tracking of grape clusters and early phenotyping from UAV video sequences

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Phenotyping is recognised as a powerful tool in plant breeding. The phenotype of a plant includes morphological and physiological characteristics, and is a consequence of the interaction between genotype and environment. Phenotyping traits are related to several characteristics, like leaf characteristics, plant phenology or canopy architecture. These traits have been studied for a long time in viticulture through ampelography, which is the science that studies the identification and classification of grapevines (*Vitis*). Hence, most of these traits are recognised by the International Organisation of Vine (OIV) and Wine and the International Plant Genetic Resources Institute (IPGRI) as descriptors for grape varieties and *Vitis* species. Bunch length and width are OIV codes 202 and 203, respectively.

Traditionally, this information is achieved manually through visual surveys, which is time-consuming, expensive, and laborious. Moreover, its measurement is subjective since it depends on the technician in charge. Therefore, remote sensing is a promising tool to obtain phenotyping traits faster, cheaper, and more objectively. Object detection is a computer vision technique that is used to identify and locate the object in an image or video. Another functionality that can be built on top of object detection is object tracking, which consists of tracking the movement of an object as it moves through the video frames. Object tracking permits counting the number of objects in a video since it assigns a unique ID to each object, while storing important information of each object. This work aims to identify and track grapevine clusters and estimate their dimensions (OIV codes 202 and 203) in an early development stage using UAV RGB videos and Deep Learning. For this purpose, the PointTrack algorithm has been successfully implemented on 29 videos, allowing multi-object tracking, cluster segmentation, and permitting the estimation of the OIV descriptors.