

MAPPING OF CANOPY FEATURES IN COMMERCIAL VINEYARDS USING MACHINE VISION

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Abstract:

Context and purpose of the study. Vineyard canopy features such canopy porosity and fruit exposure influenced microclimate, fungal disease incidence and grape composition. An objective, rapid and non-invasive method to assess and map the canopy status is needed to apply in precision viticulture. A new method for canopy status assessment and mapping based on non-invasive machine vision was applied in commercial vineyards in this work.

Material and methods. RGB images were acquired on-the-go at night and georeferenced mounting a digital camera in a quad, moving at 5 km/h. The new moving sensing platform, including a GPS-RTK and an illumination system was used in Pinot noir and Macabeo VSP commercial vineyards located in Barcelona (Spain) for producing sparkling wine. RGB images were processed using a new classification algorithm based on the Mahalanobis distance. The pixels were classified in four classes: clusters, leaves, gaps and trellis.

Results. The results were validated using Point Quadrat Analysis as reference method. Canopy porosity and fruit exposure results were mapped in both Pinot noir and Macabeo vineyards. The new RGB image-based methodology has enabled the assessment and mapping of the canopy status of VSP commercial vineyards in an easy and non-invasively way. The new methodology can be adopted by viticulturists to objectively evaluate and map the canopy features as fruit exposure and canopy porosity in commercial vineyards. Decision-making process in the vineyard management could be optimized using this information on key canopy factors.

Key words. Non-invasive sensors, sensing technologies, computer vision, precision viticulture

1. Introduction.

Mapping of canopy features in commercial vineyards using machine vision

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Context and purpose of the study

An objective, rapid and non-invasive method to assess the canopy status is needed in precision viticulture.

A new method for canopy status assessment and mapping based on non-invasive machine vision was applied in commercial vineyards in this work.

Materials & Methods

RGB Images were acquired on-the-go at night and georeferenced mounting a digital camera in a quad, moving at 5 km/h (Fig. 1). The new moving sensing platform, including a GPS-RTK and an illumination system was used in Pinot noir and Macabeo VSP commercial vineyards located in Barcelona (Spain) for producing sparkling wine.

RGB Images were processed using a new classification algorithm based on the Mahalanobis distance. The pixels were classified in four classes (Fig 2):

- Exposed clusters
- Exposed leaves
- Canopy porosity (Gaps)
- Trellis

The results were validated using Point Quadrat Analysis as reference method.



Figure 1. Mobile platform used for image acquisition on-the-go in the commercial Pinot noir and Macabeo vineyard moving at 5 km/h

Results

Canopy porosity and fruit exposure results were mapped in both Pinot noir and Macabeo vineyards (Fig. 3). The new RGB Image-based methodology has enabled the assessment and mapping of the canopy status of VSP commercial vineyards in an easy and non-invasive way.

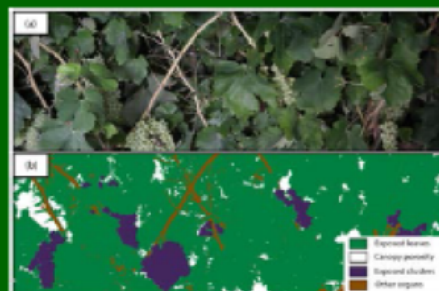


Figure 2. Canopy vine image segmentation:
a) Image of Macabeo grapevine fruit-zone acquired on-the-go at night
b) Cluster pixels identified as clusters, leaves and canopy porosity

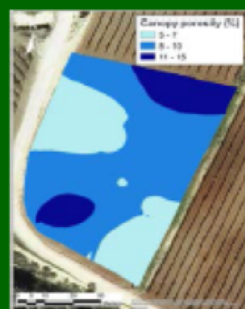


Figure 3. Mapping of canopy porosity (% gaps) in the Pinot noir commercial vineyard

Conclusions

The new methodology can be adopted by viticulturists to objectively evaluate and map the canopy features as fruit exposure and canopy porosity in commercial vineyards. Decision-making process in the vineyard management could be optimized using this information on key canopy factors.

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