A new approach for non-destructive measurement of quality and maturity parameters of peach fruits

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In order to strike a balance between ensuring the highest eating quality for the consumers and enabling marketing flexibility, most fruits are generally harvested when mature but not when fully ripe. Measures of quality and maturity stage are then performed just after harvest, at the packing facility or in the warehouse, to assess fruit *shelf-life* and sort fruit towards different distribution channels according to some organoleptic properties. Several indicators may serve this purpose, such as flesh firmness, soluble solid contents, and titratable acidity, which are generally measured with laboratory analyses (e.g. penetrometer, refractometer, pH-meter) entailing sample fruit destruction.

Non-destructive measurement techniques make use of remote/proximal sensors, e.g. high-resolution spectrometers, to retrieve fruit properties by suitable processing of the fruit reflectance spectra, thus avoiding fruit damage and waste and, in turn, allowing faster, repeated measures on each fruit of the batch. Reflectance indexes (e.g. band ratios) are typically extracted from some fruit spectra and correlated to destructive measures of specific fruit properties via linear regression. The regression coefficients are then used to infer the properties of the remaining fruits. Examining just a few spectral bands, the rich information content enclosed in the spectra is not fully exploited. Furthermore, the fruit samples used to learn the regression coefficients may originate from different rootstocks, which influence fruit quality and maturity evolution.

In this work, a new approach is adopted to fully exploit the spectra information content. Methods based on multivariate statistical models for the fruit spectra are employed to classify the fruits with respect to the rootstock. Then, the classification outcome is used to drive the linear regression procedure in a class-conditional fashion, both using the band ratios and the full spectra as regressors. Experimental results featuring peaches originating from four different rootstocks show that the proposed approach is promising for improving non-destructive measurement of fruit quality and maturity parameters.