

Smart-HAND: a low-cost and portable visible/Near Infrared prototype for measuring qualitative parameters of fruits

Sara Vignati^{1*}, Alessia Pampuri¹, Alessio Tugnolo¹, Valentina Giovenzana¹, Andrea Casson¹, Martina Zambelli¹, Riccardo Guidetti¹, Roberto Beghi¹

¹ Department of Agricultural and Environmental Sciences - Production, Territory, Agroenergy, Università degli Studi di Milano, Via Celoria 2, 20133, Milano, Italy

*Corresponding author: sara.vignati@unimi.it

Nowadays, controlling the ripening stage and quality of fruits has become crucial to obtain a high-quality finished product. Conventional ripening and quality analyses are destructive, subjective, time-consuming, and unsustainable because they often require chemicals and sample-preparation. The current methods are analytical chemical analyses and visual evaluations based on operator's skills. On the other hand, optical sensing technologies are a feasible alternative, as they are non-destructive, rapid and objective. However, the available and commercial spectrophotometers are highly expensive instruments, and they cannot be used for measurements in field. Consequently, researchers are focusing on the development of portable, simple, and user-friendly devices, which can also maintain comparable performance with bench top instruments.

Smart-HAND (Smart Handheld Analyzer Non Destructive) is a low-cost visible/near-infrared optical prototype which is composed by photodiode arrays, filters, LED, miniaturized control hardware and is equipped with 6-channel digital sensors each one. The Vis-sensor measures at 450, 500, 550, 570, 600 and 650 nm and the SW-NIR sensor gets optical information at 610, 680, 730, 760, 810 and 860 nm. The device was utilised to assess qualitative and ripening characteristics of olives and on grapes using spectroscopic data and predictive modelling (e.g. PLS – Partial Least Square). In both applications, the results have shown that the optical prototype can provide useful information related to the fruit ripeness. Further studies could improve the TRL of the device and the predictive ability of the models in order to support destructive analyzes until the last goal of replacing them.

Keywords: portable device, cost effective, field measurement, vis/NIR, chemometrics.

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