

**Title** Hyperspectral system for early detection of rottenness caused by *Penicillium digitatum* in mandarins

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### **Abstract**

Nowadays, the detection of fruit infected with *Penicillium* sp. fungi on packing lines is carried out manually under ultraviolet illumination. Ultraviolet sources induce visible fluorescence of essential oils, present in the skin of citrus and which are released by the action of fungi, thus increasing the contrast between sound and rotten skin. This work analyses a set of techniques aimed at detecting rotten citrus without the use of UV lighting. The techniques used include hyperspectral image acquisition, pre-processing and calibration, feature selection and segmentation using linear and non-linear methods for classification of fruits. Different methods such as correlation analysis, mutual information, stepwise, and genetic algorithms based on linear discriminant analysis (LDA) are studied to select the most relevant bands. Image segmentation relies on the combination of efficient band selection techniques and also on pixel classification methods such as classification and regression trees (CART) and LDA. The results were obtained using a large dataset of images of mandarins cv. "Clemenules" by applying the CART method. The hyperspectral computer vision system proposed here is capable of detecting damage caused by *Penicillium digitatum* in mandarins using a reduced set of optimally selected bands.