Title Prediction of apple fruit firmness and soluble solids content using characteristics of multispectral scattering images

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Abstract

Multispectral scattering is a promising technique for non-destructive sensing of multiple quality attributes of apple fruit. This research developed new, improved methods for processing and analyzing multispectral scattering profiles in order to design and build a better multispectral imaging system for real-time measurement of apple fruit firmness and soluble solids content. Spectral scattering images were obtained from Golden Delicious apples at four selected wavebands (680, 800, 900 and 950 nm) using a common-aperture multispectral imaging system. The scattering intensity and distance were corrected by incorporating the effect of individual apples' size. A new method of correcting scattering image profiles was proposed to minimize the effect of light source variation on the calculation of scattering function parameters. Modified Gompertz and Lorentzian functions with four parameters and their variants were evaluated and compared for predicting fruit firmness and soluble solids content using multi-linear regression and cross-validation methods. The modified Gompertz function had better prediction results with a correlation coefficient (r) of 0.896 and a standard error of prediction (SEP) of 6.50 N for firmness, and r = 0.816 and SEP = 0.92% for soluble solids content. This new function, coupled with the scattering profile correction methods, improved the multispectral scattering technique for measuring fruit quality.