Durian (Durio zibethinus) ripeness detection using thermal imaging with multivariate analysis

ABSTRACT

The detection of durian ripeness using thermal imaging is an essential study geared towards improving the current analytical methods which rely heavily on routine analysis and human labour skills. Thermal imaging was investigated in this study in order to evaluate the ripeness of durian based on the relationship of physicochemical properties and thermal image parameters. Thermal images of durians were acquired at three different ripening stages (unripe, ripe, and overripe) and the physicochemical properties of the soluble solids content, pH, firmness, moisture content, and colour changes were determined. Partial least squares (PLS) regression was used to develop quantitative prediction models with R2 values greater than 0.94 for all the physicochemical properties of durians. Principal component analysis (PCA) showed successful clustering ability of three different ripeness levels of durians. Linear discriminant analysis (LDA), k-nearest neighbour (kNN), and support vector machine (SVM) were applied for the establishment of the optimal classification modelling algorithms. The SVM classifier gave the overall best performance for the discrimination of durian ripeness with a classification accuracy of 97 %. The feasibility of thermal imaging coupled with multivariate methods demonstrated huge potential for non-destructive evaluation of durian ripeness levels.

Keyword: Durian; Thermal imaging; Multivariate analysis; Ripeness detection; Machine learning