

# Detection and classification of bruises of pears based on thermal images

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## Abstract

The detection and classification of bruises of pears based on thermal images have been investigated. A simple thermal imaging system in the long-wavelength ranges (8–14  $\mu\text{m}$ ) assembled  $\mu$  with hot air equipment was constructed to capture cleaner images. Higher velocity and temperature of the air reduced the time required to obtain a clean image, but the images were not sufficient able to discriminate the slight and invisible variation of bruises over consecutive days. The grey-level co-occurrence matrix of the thermal images were analysed, and the slight differences in the pears over consecutive days were presented in the form of a line chart. A traditional deep learning algorithm commonly used in classification of big data sets was modified to one suitable for classification of a small sample data set of thermal images (3246 samples were used as the training data set and 1125 were used as a test data set) collected from 300 pears over 10 days. The best test prediction accuracy