

Title On-line identification of seeds in mandarins with magnetic resonance imaging
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Abstract

Mandarins have been inspected using magnetic resonance imaging (MRI) in order to detect the presence of seeds. To enhance contrast between seeds and pulp, effective transverse relaxation time-weighted fast low angle shot images (703 ms acquisition time) were acquired. Stationary fruits were imaged and then the images were segmented to extract several features. The maximum radius of the region containing the seeds and the central axis r_{max} , and the perimeter of this region P were the most powerful features for discrimination between seedless and seed-containing fruits. Such features were the most robust since they showed the lowest noise-to-signal ratios (N/S). The proportions of correct classification were 88.9% and 86.7% for seedless and seed-containing fruits, respectively, under MRI stationary conditions. The performance under on-line conditions was evaluated by imaging the fruits while conveyed at 54 mm/s. An analysis of variance with the features extracted from the static images and the motion-corrected dynamic images showed that there were statistically indistinguishable. The proportions of correct classification were 92.5% and 79.5% for the seedless and seed-containing category, respectively, under MRI dynamic conditions. Reduction in the distance between categories for r_{max} was addressed as the main cause for the decrease in discrimination performance. The robustness of the motion correction procedure was highlighted by the low differences in the N/S ratio and the noise-to-measured range ratios between static and dynamic features.