

Title Citrus fruit identification and size determination using machine vision and ultrasonic sensors
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Citation 2005 ASAE Annual International Meeting, Tampa Convention Center, Tampa, Florida, 17-20 July
2005, Paper Number 053017, 1 p.
Keywords Citrus; Fruit size; Identification; Image processing; Machine vision; Ultrasonic sensor

Abstract

Machine vision and image processing have been increasingly used for agricultural applications especially for detection of crop status and quality, and crop harvesting. Estimating the size of the fruit allows growers to get a good idea of the quality of yield. A system using a camera and an ultrasonic sensor is proposed that will enable one to estimate the average size of citrus fruits. Images of the fruit laden trees were obtained using a color camera, and the distance between the fruits and the camera were obtained using ultrasonic sensors. Actual size of a sample fruit in each image was measured manually on the tree. Three different classification techniques, Bayesian, neural network and Fischer's linear discriminant were implemented to differentiate fruit from the background in the images, using hue and saturation as the separation features. The classified images were then processed to remove noise, to fill the blobs, and to separate the blobs using watershed transformation. These segmented images were then analyzed to find the diameter of the fruit in the images. Using basic trigonometry, the camera's field of view and the distance information from the ultrasonic sensors, actual size of fruit in an image was estimated. Results from the three classifiers were compared in terms of accuracy with the actual measured fruit size.