# Determination of 'Hass' avocado ripeness during storage by a smartphone camera using artificial neural network and support vector regression

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## Abstract

Avocado undergoes quality transformation during storage, which needs to be managed in order to prevent quantity losses. A machine vision system devised with a smartphone camera was used to capture 'Hass' avocado images. Color features in $L*a*b*$ and YUV (YUV color space is defined in terms of one luminance (Y) and two chrominance components (U and Y)) were extracted from the RGB images. Artificial Neural Network (ANN) and Support Vector Regression (SVR) were used compared for firmness estimation using the $L*a*b*$ and YUV color features. The results indicated the ANN model is more accurate and robust than the SVR model for estimating 'Hass' avocado firmness with $R^2$, RMSE, and RPD of 0.94, 0.38, 4.03 respectively for the model testing data set. It was concluded that the machine vision system devised with a smartphone camera and ANN model could be a low-cost tool for the determination of ripeness of 'Hass' avocado during harvest, storage, and distribution.