

## **Classification of pre-harvest avocado maturity using machine learning assisted polarization-based multispectral imaging**

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Avocado (*Persea americana*) is a climacteric fruit with significant commercial value. This study reports the development of a multispectral imaging system based on the degree of linear polarization (MSI-DoLP) to estimate the physiological maturity level of avocados *in situ*. The MSI-DoLP employs three light-emitting diodes with center emission wavelengths at 450 nm, 520 nm, and 630 nm. A mobile phone camera served as the imaging device, and two linear polarizers were used to capture DoLP images. A rotating sample holder facilitated imaging of multiple locations of the fruit. The objective was to detect the pre-harvest maturity of an avocado. A cross-sectional study design was used for the experiment. MSI-DoLP was performed on both mature and immature avocados during plucking. Samples were obtained from several locations of the central province of Sri Lanka consisting of more than 600 DoLP multispectral measurements on 100 different avocado samples. Partial Least Square Discriminant Analysis (PLS-DA), Random Forests, and Support Vector Machines (SVM) were used for the classification. The 630 nm spectral window showed the best sensitivity and selectivity for correctly identifying a mature fruit at the time of harvesting. SVM-based classification recorded the overall best accuracy (82%).

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